DOCUMENT RESUME

ED 312 489 CE 053 634

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TITLE V-TECS Guide for Roofer.
INSTITUTION South Carolina State Dept. of Education, Columbia. Office of Vocational Education.
PUB DATE 89
NOTE 463p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC19 Plus Postage.
DESCRIPTORS *Blue Collar Occupations; *Buildings; *Building Trades; *Competency Based Education; *Construction (Process); Construction Industry; Construction Materials; Maintenance; Repair; *Roofing; Skilled Occupations; Structural Elements (Construction); Vocational Education

ABSTRACT

The materials in this document are an extension of a catalog of occupational duties, tasks, and performance objectives relevant to the occupation of roofer. This document provides the following for each occupational task within each duty: (1) a standard of performance; (2) the conditions under which the task is to be performed; (3) enabling objectives; (4) at least one resource; (5) one or more teaching activities; (6) criterion-referenced measures of student performance; (7) answers to those measures; (8) practical applications; and (9) a suggested method of evaluating the practical application. The appendices contain a list of tasks associated with the seven occupational duties (applying surface materials; flashing and sealing joints; installing shingles; preparing for the job; operating and maintaining tools and power equipment; operating tankers and kettles; and repairing roofs); definitions of terms; a list of tools, equipment, and work aids; reference to the sources of the information contained in the document; a list of 93 items called "state-of-the-art literature"; and a 19-item bibliography. (CML)

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V-TECS GUIDE
FOR
ROOFER

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Columbia, South Carolina 29201

1989

CE053634

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ACKNOWLEDGEMENTS

The Roofer V-TECS Guide was developed from the Roofer V-TECS Catalog by a committee of Building Construction instructors from South Carolina. Special appreciation is extended to the following teachers who devoted their time and talents to this project:

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The State Office of Vocational Education staff members who assisted the committee were Jim Horton (Trade and Industrial Education Consultant), Dr. Shirley Cullen (Sex Equity Consultant), and Jim Lewallen (Word Processor).

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INTRODUCTION

A V-TECS Guide is an extension or a continuation of one or more V-TECS Catalogs. The V-TECS Catalog is a composition of duties, tasks, performance objectives, and performance guides which deal with the psychomotor aspect of an occupation. The catalog can be considered the blueprint of an occupation.

The catalog serves as the foundation for the V-TECS Guide. Experience has shown that the art of learning can be taught while teaching subject matter. A V-TECS Guide provides an efficient method for this process. The Guide addresses the three domains of learning: psychomotor, cognitive, and affective. The following is a brief explanation of each.

Psychomotor

Manipulative skills, such as sharpening a pencil and making a bulletin board display, are representative of activities that are psychomotor in nature. These tasks are identified in a catalog and grouped by duties and objectives. Each performance objective has a performance standard which must be met to demonstrate student proficiency in the manipulative aspect of the task.

Cognitive

Cognition is the mental process by which knowledge is acquired. To perform psychomotor tasks, students must think. Effective thinking is necessary for successful performance of job tasks. Students gain cognition through real and vicarious experiences. This guide enables the instructor to provide decision-making opportunities for students, thus developing their cognitive skills.

Affective

The affective domain deals with attitudes, interests, and values development. Desirable behavior is the learning outcome of the affective domain. This guide presents activities created to promote an understanding of self and others in a working environment. The instructor is encouraged to use the activities to stress how attitudes, values, and goal attainment influence working relationships and productivity.

USE OF V-TECS GUIDE

A V-TECS Guide is designed to provide job-relevant tasks, performance objectives, performance guides, resources, teaching activities, evaluation standards, and criterion-referenced measures. It may be used with any teaching method the instructor chooses. Although a guide contains suggestions for specific classroom activities for each identified task, teachers are encouraged to be creative in adapting the material to meet the particular needs of their students.

APPLYING SURFACE MATERIALS

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 1

TASK

Apply adhesive.

STANDARD OF PERFORMANCE OF TASK

Adhesive must cover all surface areas of the deck and must be uniformly spread.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Adhesive
Mop handles
Roller, 18"
Upright bristle broom
Job specifications
Adhesive solvent
Ribbon machine
Rubber boots
Gloves
Mop cart

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use measuring tools.
3. Select and use the ribbon machine.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, p. 247.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, p. 247.
2. Instruct the students on checking the deck to insure complete coverage and uniform spread.
3. Discuss adhesive solvent and its use.
4. Instruct the students on safety when pouring adhesive materials into mop cart.
5. Discuss the procedures for attaching roller to mop handle.
6. Discuss and demonstrate applying roller to deck in push-pull strokes.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance step of the task.

PERFORMANCE OBJECTIVE 1

CRITERION-REFERENCED MEASURE

Questions

1. What type of broom should be used to apply adhesive? ___________
2. After dipping the roller in the adhesive, it should be applied to the deck in a ___________ stroke.
3. Adhesive should not be rolled over more than a _________ work area at any one time.

Answers

1. Upright bristle broom
2. Push-pull
3. 3'

Practical Application

Have the students apply adhesive to the deck. The adhesive must cover all surface areas of the deck and must be uniformly spread.

Method of Evaluating Practical Application

Use Checklist Performance Objective 1 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 1

APPLYING ADHESIVE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected deck area where adhesive is to be applied.		
3. Prepared the deck by brooming or mopping to remove dust and debris.		
4. Determined starting point, pattern of application and stopping point for adhesive application.		
5. Poured adhesive materials into mop cart.		
6. Attached roller to mop handles.		
7. Moved mop cart with adhesive to close proximity of adhesive application.		
8. Dipped roller in adhesive; saturated roller.		
9. Applied roller to deck in push pull strokes; worked a 3' area at any one time.		
10. Continued items 7, 8, and 9 until the entire deck was covered with adhesive.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 1

APPLYING ADHESIVE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked deck to insure complete coverage and uniform spread.		
12. Smoothed excess accumulations and covered missed areas.		
13. Cleaned tools and equipment.		
14. Cleaned work area.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

1

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 2

TASK

Apply flood coating.

STANDARD OF PERFORMANCE OF TASK

Flood coating must be uniformly spread and gravel must be imbedded in the bitumen.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Gravel buggy
Gloves
Job specifications
Long handle dipper
Mop cart
Safety glasses
Shovel
Water bucket
Wheelbarrow
Rubber boots

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select tools.
3. Demonstrate safe work practices.
4. Identify and select protective clothing.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 247-248.
2. **Owens/Corning Fiberglass Roofing Products**, pp. 11-27.
3. **Manville Roofing Systems**, pp. 8-13.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 247-248, **Owens/Corning Fiberglass Roofing Products**, pp. 11-27, and **Manville Roofing Systems**, pp. 8-13.
2. Discuss safety rules in the use of tools and equipment.
3. Discuss maintaining the appropriate temperature of the asphalt at the point of application.
4. Instruct the students how to handle hot bitumen safely.
5. Instruct the students in loading the gravel buggy, and spreading gravel.
6. Discuss the importance of checking the work area.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 2

CRITERION-REFERENCED MEASURE

Questions

1. Asphalt should be approximately ______°F at the point of application.
    a. 300°-350°
    b. 400°-450°
    c. 200°-250°
    d. 450°-500°
2. When using hot bitumen, extreme caution should be observed, and ____________, ____________ should be worn.
3. When applying gravel, why should a light coat be applied first?

Answers

1. a. 400°-450°
2. Protective clothing
3. This allows the first layer to imbed itself in the bitumen.

Practical Application

Have the students apply a flood coating. The flood coating must be uniformly spread and the gravel must be imbedded in the bitumen.

Method of Evaluating Practical Application

Use Checklist Performance Objective 2 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 2

APPLYING A FLOOD COATING

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Prepared area to be flood coated.		
3. Stockpiled gravel on the roof.		
4. Filled mop cart with hot bitumen.		
5. Used a long handled dipper; dipped and spread bitumen over deck. Used long sweeping motions covering 2-3 feet in an arc. Continued this process until the work area was covered with bitumen.		
6. Loaded the gravel buggy with gravel.		
7. Located the gravel buggy in position to spread the gravel; spread by loading the shovel with gravel and swinging and tipping the shovel to disperse the gravel.		
8. Continued slinging gravel until the work area was completely and uniformly covered with gravel.		
9. Checked the work area, smoothed any excessive accumulations of gravel and filled in missed spots.		
10. Cleaned the work areas.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 3

TASK

Apply roof membrane.

STANDARD OF PERFORMANCE OF TASK

Roof membrane must not be wrinkled, torn, or contain voids.

SOURCE OF STANDARD

Roofers' Local #20. **Joint Apprenticeship Program,** p. 14.

CONDITIONS FOR PERFORMANCE OF TASK

Flat trowel
Job specifications
Roofing cement
Roofer's knife
Safety glasses
Staple gun
Staples
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select basic tools.
3. Select and use roof membrane.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, p. 247 (1983).
2. Wagner. **Modern Carpentry**, pp. 185-190 (1976).

TEACHING ACTIVITIES

1. Have the students define membrane and discuss applying roof membrane.
2. Instruct the students in inspecting the work area before applying roof membrane.
3. Discuss trimming excessive membrane from edges.
4. Discuss the care and maintenance of tools and equipment.
5. Have the students complete the performance step of the task.

PERFORMANCE OBJECTIVE 3

CRITERION-REFERENCED MEASURE

Questions

1. ____________is used to trim excess membrane from edges.
2. Roof membrane must not be ____________, ____________or ____________.
3. Roof cement must be applied in ____________ workable sections.

Answers

1. Roofer's knife
2. Wrinkled, torn, or contain voids
3. Evenly

Practical Application

Have the students apply a roof membrane. The roof membrane must not be wrinkled, torn, or contain voids.

Method of Evaluating Practical Application

Use Checklist Performance Objective 3 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 3

APPLYING ROOF MEMBRANE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected the work area.		
3. Determined starting point and application pattern.		
4. Applied coat of roof cement evenly over a workable section of the deck.		
5. Unrolled, measured and cut membrane to size.		
6. Placed membrane over adhesive; stapled edges to prevent movement.		
7. Broomed membrane lightly to bind roof membrane to adhesive.		
8. Repeated items 4, 5, 6 and 7 until entire work area was covered.		
9. Trimmed excess membrane from edges.		
10. Removed wrinkles and made sure entire work area was covered.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 4

TASK

Attach drip edge.

STANDARD OF PERFORMANCE OF TASK

The drip edge must be flush with the deck, with a 3/4" overhang, and the overhang must be bent downward at an approximate 45° angle.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Adjustable pliers
Claw hammer
Electric drill
Galvanized fasteners
Job specifications
Measuring tape
Safety glasses
Tin snips

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select fasteners.
3. Select and use measuring tools.
4. Calculate angles.
5. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 247-248.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 247-248.
2. Have the students review safety rules in the use of power tools.
3. Instruct the students how to inspect and prepare the eave or rake.
4. Discuss measuring, cutting and positioning the drip edge.
5. Have the students define and discuss overhang.
6. Instruct the students how to bend the outer edge of the drip edge downward approximately 45°.
7. Have the students complete the performance step of the task.

PERFORMANCE OBJECTIVE 4

CRITERION-REFERENCED MEASURE

Questions

1. The drip edge must have at least ______ overhang.
   a. $\frac{3''}{4}$
   b. $\frac{1''}{2}$
   c. $\frac{5''}{8}$
   d. $\frac{13''}{16}$
2. The overhang must be bent downward approximately at a ______ angle.
   a. 32°
   b. 60°
   c. 45°
   d. 90°
3. The drip edge is applied to the _______ or _______.

Answers

1. a
2. c
3. Eave or rake

Practical Application

Have the students attach a drip edge. The drip edge must be flush with the deck, with an overhang of 3/4", and the overhang must be bent downward approximately at a 45° angle.

Method of Evaluating Practical Application

Use Checklist Performance Objective 4 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 4

ATTACHING A DRIP EDGE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared eave or rake where drip edge was to be attached.		
3. Measured the length of the eave or rake.		
4. Measured, cut and positioned the drip edge along the eave or rake.		
5. Laid the first strip of drip edge at the corner; made sure there was at least a 3/4" overhang.		
6. Fastened the drip edge in place and bent the outer edge of the drip edge downward approximately 45°. (Drilled holes, if necessary, in the roof deck to accommodate fasteners).		
7. Made adjustments to ensure that drip edge was flush with the deck and secured.		
8. Checked for 3/4" overhang which was bent downward.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

2

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 5

TASK

Attach gravel guard.

STANDARD OF PERFORMANCE OF TASK

Corners of gravel guard must be lap sealed, metal flange must be flush with roof, and gravel must not wash over guard.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, pp. 381-382.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Electric drill
Galvanized fasteners
Job specifications
Measuring tape
Metal cutters
Pointed hand trowel
Roofing cement
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select fasteners.
3. Select and use measuring tools.
4. Select and use hand and power tools.
5. Identify and select roof cement.
6. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 247-248.
2. **Manville Roofing Systems**, pp. 13, 71-72.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 247-248, and **Manville Roofing Systems**, pp. 13, 71-72.
2. Discuss preparation of the work area.
3. Instruct the students on safety rules when cutting the gravel guard.
4. Instruct students on making a 1/2" V-shaped notch.
5. Discuss the application of roofing cement.
6. Discuss the application of a gravel strip.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 5

CRITERION-REFERENCED MEASURE

Questions

1. The gravel guard should be notched on both ends making about a ______ inch V-shaped notch.
2. Gravel guards are installed after the ____________________________ or ____________.
3. A ____________ pattern should be used when nailing a gravel strip flange to the roof.

Answers

1. 1/2
2. Base felt or membrane
3. Zig zag

Practical Application

Have the students attach a gravel guard. The corners of the gravel guard must be lap sealed, the metal flange must be flush with the roof, and the gravel must not wash over the guard.

Method of Evaluating Practical Application

Use Checklist Performance Objective 5 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 5

ATTACHING A GRAVEL GUARD

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared the work area.		
3. Laid out, measured and cut the gravel guard.		
4. Notched both ends of the gravel guard making about a 1/2" V-shaped notch.		
5. Positioned the gravel guard strip in proximity to where it will be fastened.		
6. Applied roofing cement to the flange of the gravel strip.		
7. Positioned and secured gravel strip to the roof; overlapped the edges of the gravel strip by approximately one inch, kept flange flush with the roof.		
8. Checked to ensure the flange was flush with the roof; tapped with a hammer to make flush.		
9. Applied the roofing cement to the overlapped joints.		
10. Cleaned the work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

2

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 6

TASK

Attach lead collar to vent.

STANDARD OF PERFORMANCE OF TASK

Lead collar must be mechanically secure, free of voids between the collar and pipe, and collar must be watertight.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 87.
U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 14.

CONDITIONS FOR PERFORMANCE OF TASK

Adjustable wrench
Blueprint/Job specifications
Caulking compound
Flat blade screwdriver
Flat hand trowel
Roofing knife
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications and blueprint.
2. Identify and select hand tools.
3. Identify and select caulking compound.
4. Select and use hand trowels.
5. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 14 and 30.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products**, pp. 14 and 30.
2. Instruct the students in visually checking the area around the vent pipe.
3. Instruct the students in placing vent collar over the vent pipe.
4. Instruct the students on tightening the collar screw.
5. Instruct the students on applying the caulking compound.
6. Have the students review and discuss activities 4 and 5 under TEACHING ACTIVITIES.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 6

CRITERION-REFERENCED MEASURE

Questions

1. Before installing the vent flashing, the roofer should check the ____________________ specifications.
2. The lead collar is attached to the vent with a ________________________.
3. When should you check for leaks and fit?
    a. After it rains
    b. Before it rains
    c. After applying caulking compound
    d. None of the above

Answers

1. Local code
2. Collar screw
3. c

Practical Application

Have the students attach a lead collar to a vent. The lead collar must be mechanically secure, free of voids between the collar and pipe, and the collar must be watertight.

Method of Evaluating Practical Application

Use Checklist Performance Objective 6 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 6

ATTACHING LEAD COLLAR TO VENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Read blueprint and job specifications.		
2. Inspected the area around the vent pipe, and cleaned the area of dust and debris.		
3. Placed the vent collar over vent pipe; slid the vent collar down until it bottomed out and was flush with the roof contour.		
4. Tightened the collar screw, mechanically securing the collar to the vent.		
5. Applied caulking compound around collar top and vent pipe; filled voids between pipe and collar by tapping in compound with the end of a trowel or screwdriver.		
6. Checked for leaks and fit.		
7. If readjusting was necessary, repeated items 4 and 5.		
8. Cleaned the work area.		
9. Cleaned and stored all tools.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 7

TASK

Attach pitch pans.

STANDARD OF PERFORMANCE OF TASK

Pitch pans must not have fishmouths, must be filled with adhesive, and glaze must be flush with contour of roof.

SOURCE OF STANDARD

State of Georgia Writing Team
Johnson. **Roofer's Handbook,** p. 9.

CONDITIONS FOR PERFORMANCE OF TASK

Blueprint specifications
Cold adhesive
Glaze spreader
Mop
Mop cart
Roofing glaze
Roofing knife
Roofing paper
Rubber boots
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications and blueprint.
2. Select and apply adhesive.
3. Identify and use glaze spreader.
4. Demonstrate safe work practices.

RESOURCE

Manville Roofing Systems, pp. 64-66.

TEACHING ACTIVITIES

1. Have the students read and discuss **Manville Roofing Systems,** pp. 64-66.
2. Instruct the students in the use of the glaze spreader.
3. Instruct the students in inspecting the area where the pitch pan will be placed.
4. Discuss the application of adhesive and felt.
5. Discuss checking a pitch pan for fishmouths.
6. Discuss the care and maintenance of tools and equipment.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 7

CRITERION-REFERENCED MEASURE

Questions

1. The pitch pan MUST/MUST NOT have a fishmouth.
2. The ____________ is used to cut the roofing paper.
    a. Glaze spreader
    b. Cart
    c. Roofing glaze
    d. Roofer's knife
3. The glaze must be flush with the ____________ of the roof.

Answers

1. MUST NOT
2. d. Roofer's knife
3. Contour

Practical Application

Have the students attach pitch pans. The pitch pans must not have fishmouths, must be filled with adhesive, and the glaze must be flush with the contour of the roof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 7 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 7

ATTACHING PITCH PANS

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Read blueprint or job specifications.		
2. Inspected area where pitch pans were placed; cleaned area of dust or debris.		
3. Positioned pitch pans in the area to be placed, took note of placement and flange areas.		
4. Removed pitch pan and applied adhesive to area where pitch pans were placed.		
5. Cut a piece of felt to cover the adhesive and placed felt over adhesive.		
6. Covered felt with two pieces of roofing paper; the second piece, laid on top of the first, was slightly larger than the first piece of roofing paper.		
7. Applied sufficient pressure to roofing paper to implant the felt in the adhesive.		
8. Primed the top of the flange on the pitch pan with a light coat of adhesive.		
9. Glazed the edges of the pitch pan area, contouring the glaze to the roof.		
10. Filled the pitch pans with adhesive.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 7

ATTACHING PITCH PANS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked pitch pans for fishmouths and ensured glaze was flush with the roof.		
12. Cleaned the work area.		
13. Cleaned and stored tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature   Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 8

TASK

Envelope edges of felt.

STANDARD OF PERFORMANCE OF TASK

Envelope edge fold must be bonded to bitumen; there must be no puckers or wrinkles.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

- Bitumen
- Claw hammer
- Galvanized fasteners
- Gloves
- Job specifications
- Mop
- Mop car
- Roofer's knife
- Rubber boots
- Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized fasteners.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, p. 14.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products,** p. 14.
2. Discuss preparing the deck.
3. Instruct the students in applying felt along the edge of the deck.
4. Instruct the students in the use of fasteners.
5. Instruct the students in applying hot bitumen.
6. Discuss the care and maintenance of tools and equipment.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 8

CRITERION-REFERENCED MEASURE

Questions

1. When applying felt on the edge, there must be no __________ or __________.
2. What type of fasteners should be used to fasten felt to the deck?
3. How much of the felt strip should overlap the edge?
   a. 6"-8"
   b. 4"-6"
   c. 6"-10"
   d. 8"-12"

Answers

1. Puckers or wrinkles
2. Galvanized
3. c

Practical Application

Have the students envelope edges of felt. The envelope edge fold must be bonded to the bitumen; there must be no puckers or wrinkles.

Method of Evaluating Practical Application

Use Checklist Performance Objective 8 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 8

ENVELOPING EDGES OF FELT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Prepared deck area around the edge of the roof by removing dust and debris.		
3. Measured, cut and laid a strip of felt along the edge of the deck leaving a 6" to 10" overhang.		
4. Fastened felt to the deck.		
5. Measured, cut and laid the insulation on the deck; ensured that the insulation overlaps the felt strip.		
6. Mopped a strip of bitumen along the edges of the felt strip.		
7. Folded a 6"-10" overlap back over the edge; applied pressure to force overlap to be bound by bitumen.		
8. Walked the felt down to ensure binding.		
9. Checked for wrinkles and puckers.		
10. Walked down wrinkles or puckers.		
11. Cleaned the work area.		
12. Cleaned all tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 9

TASK

Lay base sheet to a cricket (saddle).

STANDARD OF PERFORMANCE OF TASK

Base sheet must not be torn or wrinkled; there must be no voids visible on the cricket (saddle).

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 61-62.

CONDITIONS FOR PERFORMANCE OF TASK

Bitumen
Chalk line
Claw hammer
Galvanized fasteners
Gloves
Job specifications
Measuring tape
Mop
Mop cart
Roofer's knife
Rubber boots
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized fasteners.
3. Identify and use measuring tape.
4. Demonstrate safe work practices.

RESOURCE

Manville Roofing Systems, pp. 54-60.

TEACHING ACTIVITIES

1. Have the students read and discuss **Manville Roofing Systems**, pp. 54-60.
2. Discuss methods of inspecting and preparing the work area.
3. Instruct the students on applying hot bitumen to the cricket (saddle).
4. Instruct the students on cutting the base sheet.
5. Instruct the students on checking the base.
6. Discuss the care and maintenance of tools and equipment.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 9

CRITERION-REFERENCED MEASURE

Questions

1 When applying the base sheet to the cricket (saddle), it must not be __________ or __________ and have any __________.

2. When mopping hot bitumen to the cricket (saddle), always start at the __________ point.

3. When applying hot bitumen, it should be spread approximately ________ wide.
   - a. 18"
   - b. 2'
   - c. 3'
   - d. 2'6"

Answers

1. Torn, wrinkled, voids
2. Lowest
3. b

Practical Application

Have the students lay a base sheet to a cricket (saddle). The base sheet must not be torn or wrinkled; there must be no voids visible on the cricket (saddle).

Method of Evaluating Practical Application

Use Checklist Performance Objective 9 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 9

LAYING A BASE SHEET TO A CRICKET(SADDLE)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared the work area.		
3. Determined starting point and pattern to lay the base sheet.		
4. Laid chalk line to pattern.		
5. Positioned tools and equipment.		
6. Mopped lowest point of cricket with hot bitumen; worked upward to point of cricket using left/right motions approximately 2 feet wide.		
7. Unrolled, measured and cut the base sheet to size.		
8. Placed the base sheet on bitumen, worked from bottom to top.		
9. Trimmed the base sheet to fit.		
10. Checked the base sheet for wrinkles, voids and tears.		
11. Removed wrinkles and voids; cut and patched voids and tears.		
12. Cleaned the work area.		
13. Cleaned all tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 10

TASK

Lay cant strip.

STANDARD OF PERFORMANCE OF TASK

Cant strip ends must be butted, pressure fitted to the unit, and must not be ragged.

SOURCE OF STANDARD

State of Georgia Writing Team
Roofers' Local #20. **Joint Apprenticeship Program**, p. 11.

CONDITIONS FOR PERFORMANCE OF TASK

- Bitumen
- Claw hammer
- Galvanized fasteners
- Gloves
- Job specifications
- Measuring tape
- Mop
- Mop cart
- Pointing trowel
- Roofer's knife
- Safety glasses

ENABLING OBJECTIVES

1. Identify and select galvanized fasteners.
2. Read and interpret job specifications.
3. Select and use measuring tools.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 15, 68-78.

TEACHING ACTIVITIES

1. Have the students read and discuss Bitumen application: **Owens-Corning Fiberglass Products**, pp. 15, 68-78.
2. Discuss preparation of the work area.
3. Discuss measuring, cutting and positioning the cant strip.
4. Instruct the students in applying hot bitumen.
5. Instruct the students in applying bitumen to the top of the cant strip to seal the edges.
6. Discuss the care and maintenance of tools and equipment.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 10

CRITERION-REFERENCED MEASURE

Questions

1. Cant strips should be placed on top of the __________.
   a. Roof insulation
   b. Membrane
   c. Curbs
   d. Metal roof
2. Cant strips should project ________ to ________ inches from the outer face of the wall.
3. __________ wood should be used when using wood cant strips.

Answers

1. a
2. 2 to 4
3. Treated

Practical Application

Have the students lay a cant strip. The cant strip ends must be butted, pressure fitted to the unit, and must not be ragged.

Method of Evaluating Practical Application

Use Checklist Performance Objective 10 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 10

LAYING A CANT STRIP

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured, cut and positioned cant strip.		
4. Trimmed cant strip to fit. NOTE: If cant strip was mechanically fastened in place, items 5A, 6A, and 7A were to be followed after item 4.		
5. Strip mopped cant strip area.		
5A. Positioned cant strip to fit.		
6. Placed cant strip and positioned it to fit in the mopped area.		
6A. Mechanically fastened cant strip in position.		
7. Applied bitumen to the top of the cant strip to seal edges.		
7A. Applied bitumen or cold adhesive over cant strip to seal edges.		
8. Applied slight pressure to cant strip to bind to bitumen.		
9. Checked for seal, butting, and raggedness.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 10

LAYING A CANT STRIP

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 11

TASK

Lay canvas.

STANDARD OF PERFORMANCE OF TASK

Canvas must cover roof, have no rips, wrinkles or tears.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

- Bucket
- Chalk line
- Claw hammer
- Cloth shears
- Copper fasteners
- Job specifications
- Linseed oil
- Manufacturer's specifications
- Measuring tape
- Planer
- Push broom
- Roller, paint
- Roofer's knife
- Rubber boots
- Sander
- Upright broom
- Weather resistant paint
- Wood chisel

ENABLING OBJECTIVES

1. Read and interpret job specifications and manufacturer's specifications.
2. Identify and select copper fasteners.
3. Select and use hand tools, measuring tools, and paint roller.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Torch-on Applications, pp. 15-16.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Torch-on Applications,** pp. 15-16.
2. Discuss preparing the deck.

PERFORMANCE OBJECTIVE 11

TEACHING ACTIVITIES (Continued)

3. Discuss safety rules when laying canvas.
4. Instruct the students in determining laydown pattern.
5. Instruct the students in nailing canvas.
6. Instruct the students in applying linseed oil and calcined plaster of paris.
7. Instruct the students in making a visual check for wrinkles, tears, voids, and rips.
8. Instruct the students in making adjustments.
9. Discuss the care and maintenance of their work.
10. Have the students complete the performance steps of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Before laying canvas, the deck should be __________ and __________.
2. __________ or __________ will provide the best base for a canvas deck.
3. Explain the application of linseed oil to canvas.

Answers

1. Inspected, prepared
2. Soft pine or spruce
3. Saturate canvas with linseed oil, then apply linseed oil in short, vertical strokes.

Practical Application

Have the students lay canvas roofing. The canvas must cover the roof, have no rips, wrinkles or tears.

Method of Evaluating Practical Application

Use Checklist Performance Objective 11 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 11

LAYING CANVAS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specification regarding the type, grade and handling of the canvas.		
3. Inspected and prepared deck for laying canvas.		
4. Prepared deck by toe-nailing, planing, and sanding high spots.		
5. Determined laydown pattern.		
6. Snapped chalk lines to conform to laydown pattern.		
7. Laid a strip of canvas from one end of the roof to the other; allowed canvas a 6" overlap or run-up at the sides of the roofing area.		
8. Smoothed out wrinkles and secured the canvas using copper nails placed 1/2" from the edge of the material and 1" apart.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 11

LAYING CANVAS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Laid second strip alongside the first conforming to chalk lines, allowed for a 3" overlap at seams, worked from the center of each strip toward ends.		
10. Continued items 7 through 9 until deck is covered.		
11. Checked area for wrinkles, tears or voids.		
12. Made adjustments.		
13. Saturated canvas with linseed oil. Applied linseed oil in short, vertical strokes, worked backward from one edge of the roof; worked 3' areas to insure coverage.		
14. While oil was still wet, rolled surface area with calcined plaster of paris. (Worked from one edge of the roof backward using short, vertical strokes to apply the plaster of paris; worked a 3' area at a time.)		
15. Allowed time for plaster of paris to dry.		
16. Applied two coats of weatherproof roofing paint.		
17. Checked roof area for voids, tears, rips.		
18. Made adjustments.		
19. Cleaned work area.		
20. Cleaned tools and equipment.		
21. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 12

TASK

Lay capsheet.

STANDARD OF PERFORMANCE OF TASK

Capsheet must be bonded to the surface with a minimum of 1/2" overlap with no wrinkles or tears.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Job specifications
Measuring tape
Mop
Mop cart
Roofer's knife
Roofing cement
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use measuring tools.
3. Identify and select roof cement.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Torch-on Applications, pp. 11-12.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Torch-on Applications,** pp. 11-12.
2. Discuss preparing the work area.
3. Instruct the students in determining laydown pattern.
4. Instruct the students in applying roof cement.
5. Discuss positioning the capsheet.
6. Instruct the students in trimming the capsheet.
7. Discuss checking for tears and wrinkles.
8. Discuss the care and maintenance of tools and equipment.
9. Have the students complete performance steps of the task.

PERFORMANCE OBJECTIVE 12

CRITERION-REFERENCED MEASURE

Questions

1. Before applying the capsheet, assure the surface is clean and free of all __________ and __________.
2. The capsheet should be positioned with at least __________ overlap on seams and edges.
3. A __________ is used to remove wrinkles and imbed the capsheet in the adhesive.

Answers

1. Dirt and debris
2. 1/2"
3. Broom

Practical Application

Have the students lay a capsheet. The capsheet must be bonded to the surface with a minimum of 1/2" overlap with no wrinkles or tears.

Method of Evaluating Practical Application

Use Checklist Performance Objective 12 to determine if the assignment was completed accurately.

4

CHECKLIST FOR PERFORMANCE OBJECTIVE 12

LAYING CAPSHEET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured area and determined starting point and laydown pattern.		
4. Laid chalk lines to conform to laydown pattern.		
5. Applied roofing cement; used a mop, worked in left/right motions covering suitable work area.		
6. Unrolled, measured and cut capsheet.		
7. Positioned capsheet over mopped area and allowed for at least 1/2" overlap on seams and edges.		
8. Continued with items 5, 6, and 7 until entire work area was covered.		
9. Trimmed capsheet to fit.		
10. Broomed capsheet to remove wrinkles and imbedded it in the adhesive.		
11. Checked for tears and wrinkles.		
12. Rebroomed and patched.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 12

LAYING CAPSHEET

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 13

TASK

Lay felt over hot binder.

STANDARD OF PERFORMANCE OF TASK

Felt must be bonded to binder with no wrinkles or tears; the entire work area must be covered.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 125-128.

CONDITIONS FOR PERFORMANCE OF TASK

Job specifications
Measuring tape
Roofer's knife
Rubber boots
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use measuring tape.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Torch on Applications, pp. 12-16.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Torch on Applications**, pp. 12-16.
2. Discuss methods of inspecting the work area.
3. Instruct the students on safety rules when working with hot binders.
4. Instruct the students in positioning the felt roll over the binder.
5. Instruct the students in keeping felt aligned with the binder.
6. Instruct the students on safety rules when cutting and trimming felt.
7. Instruct the students in removing wrinkles from felt.
8. Discuss the care and maintenance of tools and equipment.
9. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 13

CRITERION-REFERENCED MEASURE

Questions

1. A __________ knife is used to cut and trim felt.
2. Always wear protective clothing when working with __________ __________.
3. There are two ways of insuring that the felt will bind to the binder. They are __________ and __________.

Answers

1. Roofer's
2. Hot binders
3. Brooming and walking down

Practical Application

Have the students lay felt over hot binder. The felt must be bonded to binder with no wrinkles or tears; the entire work area must be covered.

Method of Evaluating Practical Application

Use Checklist Performance Objective 13 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 13

LAYING FELT OVER HOT BINDER

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected work area to insure hot binder had been applied.		
3. Determined starting point and pattern of laying felt.		
4. Positioned felt roll over the binder so that it was unrolled on top of the binder on the correct ply line.		
5. Unrolled felt; kept the felt aligned with binder while it was being unrolled.		
6. Cut and trimmed felt at edge of binder.		
7. Repeated items 4, 5, and 6 until entire work area was covered.		
8. Broomed and walked down felt to insure felt was bonded to binder.		
9. Trimmed and cut felt to fit.		
10. Checked for wrinkles and tears.		
11. Removed wrinkles by walking down or brooming.		
12. Patched tears in felt.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 13

LAYING FELT OVER HOT BINDER

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 4

TASK

Lay insulation.

STANDARD OF PERFORMANCE OF TASK

Insulation must be bound to deck, ends must be butted; there must be no gaps in insulation coverage.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 125-128.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Mechanical fasteners
Mop
Mop cart
Roofer's knife
Tape
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized and mechanical fasteners.
3. Select and use measuring tools.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Roof Insulation Products Reference and Application Guide, pp. 8-33.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Roof Insulation Products Reference and Application Guide**, pp. 8-33.
2. Discuss preparation of the work area.
3. Instruct the students on safety rules when cutting and trimming insulation.
4. Instruct the students in applying bonding agent to deck.
5. Instruct the students in fastening insulation to deck.
6. Instruct the students in taping butted end of insulation.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 14

CRITERION-REFERENCED MEASURE

Questions

1. Insulation ends must be __________ and __________.
2. The bonding agent should be applied with a __________.
    a. Tape
    b. Claw hammer
    c. Cart
    d. Mop
3. Insulation is fastened to wood decks with __________fasteners.

Answers

1. Butted and taped
2. d
3. Galvanized

Practical Application

Have the students lay insulation. The insulation must be bound to the deck, ends must be butted; there must be no gaps in insulation coverage.

Method of Evaluating Practical Application

Use Checklist Performance Objective 14 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 14

LAYING INSULATION

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined insulation specifications.		
4. Determined starting point and laydown pattern.		
5. Measured, cut/trimmed insulation to fit area to be worked.		
6. Applied bonding agent to deck, used a mop and applied bonding agent along a strip a little wider than the width of the insulation.		
7. Laid insulation over bonding agent; applied slight pressure to ensure insulation was bonded to the deck.		
8. Fastened insulation to deck. (For wood deck, used galvanized fasteners; for metal deck, used mechanical fasteners.)		
9. Taped butted ends of the insulation.		
10. Checked area for bonding, butting, and gaps.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 14

LAYING INSULATION

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 15

TASK

Lay roll roofing.

STANDARD OF PERFORMANCE OF TASK

Roofing must bind to the deck, be free of wrinkles, voids or tears; all nails must be concealed and a 3" lap maintained at the seams.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 34-35.

CONDITIONS FOR PERFORMANCE OF TASK

Buckets
Job specifications
Claw hammer
Chalk line
Fold-out ruler
Galvanized fasteners
Manufacturer's specifications
Plastic cement
Push broom
Roofer's knife
Rubber boots

ENABLING OBJECTIVES

1. Read and interpret job specifications and manufacturer's specifications.
2. Identify and use fold-out ruler.
3. Identify and select fasteners.
4. Identify and select plastic.
5. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 245-246.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 245-246.
2. Discuss preparing the deck.
3. Discuss and interpret various roof pitches.
4. Instruct the students in applying starter course.
5. Discuss cold weather application.

PERFORMANCE OBJECTIVE 15

TEACHING ACTIVITIES (Continued)

6. Instruct the students in fastening top edge of the strip with galvanized fasteners.
7. Instruct the students in strip mopping adhesive.
8. Discuss the care and maintenance of tools and equipment.
9. Have the students complete the performance steps of the task.

CRITERION-REFERENCED MEASURE

Questions

1. When laying roll roofing, all nails must be concealed and a _________ lap maintained at the seams.
    - a. 3"
    - b. 2 1/2"
    - c. 2"
    - d. 1 1/2"
2. Adhesive must be brushed on at the rate of _________ per square foot.
    - a. 3 gallons
    - b. 2 1/2 gallons
    - c. 2 gallons
    - d. 1 1/2 gallons
3. When laying roll roofing in cool or cold weather, allow roll roofing material to _______ prior to placing.

Answers

1. a
2. d
3. Warm

Practical Application

Have the students lay roll roofing. The roofing must bind to the deck, be free of wrinkles, voids or tears; all nails must be concealed and a 3" lap maintained at the seams.

Method of Evaluating Practical Application

Use Checklist Performance Objective 15 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 15

LAYING ROLL ROOFING

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications regarding use of roll roofing.		
3. Inspected and prepared deck area.		
4. Determined pitch of roof.		
5. Determined laydown pattern and snapped chalk line to conform to the pattern.		
6. Strip mopped plastic cement or cold adhesive along starter course area.		
7. Positioned starter strip of roll roofing in the adhesive and broomed or walked down to eliminate wrinkles.		
8. Fastened top edge of the strip with flat head galvanized fasteners; nailed 1/2" from edge and 1" apart.		
9. Positioned second strip of roll roofing on top of first strip in an inverted position.		
10. Strip mopped adhesive along the chalk lines for the second strip; allowed for a 3" overlap at seams.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 15

LAYING ROLL ROOFING

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. When adhesive applications were completed, positioned second strip of roll roofing by flopping it over into the adhesive strip; allowed for a 3" overlap at seams.		
12. Brushed and walked down the roll roofing strip to eliminate wrinkles and bonded the material to deck; secured as stated in item 8.		
13. Repeated items 9 through 12 until work area was covered.		
14. Checked work area for voids, tears or wrinkles.		
15. Made adjustments.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 16

TASK

Lay vapor retarders.

STANDARD OF PERFORMANCE OF TASK

Vapor retarders must be bonded to the deck; there must be no tears or voids.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook,** pp. 100-101.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Mop
Mop cart
Roller
Roofer's knife
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized fasteners.
3. Identify and use measuring tape.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Build-up Roofing Products, Bitumen Applications, pp. 13-17.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Build-up Roofing Products, Bitumen Applications,** pp. 13-17.
2. Discuss methods of inspecting and preparing the work area.
3. Discuss different types of decks.
4. Instruct the students in attaching vapor retarder.
5. Instruct the students in applying bonding to deck.
6. Instruct the students in aligning vapor retarders with bonding agent.
7. Instruct the students on safety rules when cutting the vapor retarder.
8. Discuss the care and maintenance of tools and equipment.
9. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 16

CRITERION-REFERENCED MEASURE

Questions

1. The vapor retarder is attached to a __________.
2. A roofer's knife is used to __________ and __________ the vapor retarder.
3. __________ __________ are used to secure the vapor retarder on wooden decks.

Answers

1. Roller
2. Trim and cut
3. Galvanized fasteners

Practical Application

Have the students lay vapor retarders. The vapor retarders must be bonded to the deck; there must be no tears or voids.

Method of Evaluating Practical Application

Use Checklist Performance Objective 16 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 16

LAYING VAPOR RETARDERS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined type of deck, starting point, and laydown pattern.		
4. Attached vapor retarder to roller and positioned roll at pre-determined starting point.		
5. Applied bonding to deck, applied one strip of bonding slightly under width of vapor retarder.		
6. Rolled vapor retarder on bonding agent and made sure retarder was aligned with bonding agent.		
7. Trimmed and cut vapor retarder to fit.		
8. Walked or broomed vapor retarder down.		
9. Repeated items 4, 5, and 7 until work area was completely covered.		
10. Inspected work area for bonding, tears and voids.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

6

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 17

TASK

Mop finishing plies to a cricket.

STANDARD OF PERFORMANCE OF TASK

Finishing plies must be bonded to the bitumen, must not be torn or contain voids, and must conform to the roof contour.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 61-62.
Reed. **Residential Carpentry**, p. 368.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Gloves
Hot bitumen
Job specifications
Measuring tape
Mop
Mop cart
Roofer's knife
Rubber boots
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use measuring tape.
3. Demonstrate safe work practices.

RESOURCE

Manville Roofing Systems, pp. 54-60.

TEACHING ACTIVITIES

1. Have the students read and discuss **Manville Roofing Systems**, pp. 54-60.
2. Discuss methods of inspecting and preparing the work area.
3. Instruct the students in applying hot bitumen.
4. Instruct the students on safety rules when trimming/cutting tiles to fit.
5. Instruct the students on checking the cricket to insure finishing plies are bonded.
6. Discuss the care and maintenance of tools and equipment.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 17

CRITERION-REFERENCED MEASURE

Questions

1. When applying bitumen to cricket, always start from the __________ point.
2. When applying hot bitumen, work approximately a __________ foot area at a time.
   a. 1
   b. 2
   c. 3
   d. 4
3. Check cricket to ensure finishing plies are bonded and plies conform to the roof __________.

Answers

1. Lowest
2. b
3. Contour

Practical Application

Have the students mop finishing plies to a cricket. The finishing plies must be bonded to the bitumen, must not be torn or contain voids, and must conform to the roof contour.

Method of Evaluating Practical Application

Use Checklist Performance Objective 17 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 17

MOPPING FINISHING PLIES TO A CRICKET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Positioned bitumen and finishing plies near the work area.		
4. Applied bitumen to cricket starting from the lowest point to the highest. Worked approximately a two foot area at a time.		
5. Positioned finishing plies on top of bitumen, applied pressure to insure plies were bonded to the bitumen.		
6. Trimmed/cut tiles to fit.		
7. Repeated items 4, 5, and 6 until entire cricket was covered with finishing plies.		
8. Checked cricket to ensure finishing plies were bonded, there were no tears or voids, and plies conform to the roof contour.		
9. Made adjustments where necessary.		
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 18

TASK

Mop rolled roofing with hot bitumen (spot, strip, solid).

STANDARD OF PERFORMANCE OF TASK

Roofing must be bound to the deck with no voids, wrinkles and tears.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 100-101.
Roofers' Local #20. **Joint Apprenticeship Program**, p. 5.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk lines
Gloves
Hot bitumen
Job specifications
Mop
Mop cart
Roofer's knife
Rubber boots
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Read and interpret degrees in temperature measurement.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Bitumen Application, pp. 13-17.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Bitumen Application**, pp. 13-17.
2. Discuss methods of inspecting and preparing the work area.
3. Discuss types of roof pitch and determine mopping technique used.
4. Instruct the students on applying hot bitumen to high pitched and all other roofs.
5. Instruct the students on safety rules when trimming and cutting roll roofing.
6. Instruct the students in removing wrinkles and insure binding.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 18

CRITERION-REFERENCED MEASURE

Questions

1. Bitumen must be applied at a temperature of approximately ________ degrees.
2. A ________ ________ is used to outline area to be rolled.
3. The spot mopping technique is used on __________ roofs.

Answers

1. 450
2. Chalk line
3. High pitched

Practical Application

Have the students mop the rolled roofing with hot bitumen (spot, strip, solid). The roofing must be bound to the deck with no voids, wrinkles and tears.

Method of Evaluating Practical Application

Use Checklist Performance Objective 18 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 18

MOPPING ROLLED ROOFING WITH HOT BITUMEN (SPOT, STRIP, SOLID)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined roof pitch.		
4. Outlined area to be rolled using chalk lines.		
5. Positioned roofing materials and equipment near work location.		
6. Unrolled and stretched the rolled roofing.		
7. Applied hot bitumen. a. High pitched roof (1) Dipped mop in bitumen. (2) Applied bitumen to deck in short circular motions keeping the spots approximately 2 1/2 - 3 feet in diameter and approximately two feet between spots. (3) Laid a pattern of spots to accommodate one width of rolled roofing. b. All other roofs (1) Dipped mop in bitumen. (2) Applied to deck in left to right motions, made sure there were no voids in the bitumen. (Worked an area a little wider than the width of the rolled roofing.)		

CHECKLIST FOR PERFORMANCE OBJECTIVE 18

MOPPING ROLLED ROOFING WITH HOT BITUMEN (SPOT, STRIP, SOLID)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Positioned rolled roofing on top of bitumen.		
9. Trimmed and cut rolled roofing to fit.		
10. Walked or broom rolled roofing to remove wrinkles and insure binding.		
11. Repeated items 6 through 10 until work area was completely covered.		
12. Checked work area for voids, wrinkles, tears and binding.		
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 19

TASK

Nail a base sheet.

STANDARD OF PERFORMANCE OF TASK

Base sheet must not have tears or fishmouths and fasteners must be spaced according to manufacturer's specifications.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 100-101.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Job specifications
Manufacturer's specifications
Measuring tape
Nail apron
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized fasteners.
3. Identify and use measuring skills needed.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Bitumen Application, pp. 13-17.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Bitumen Application,** pp. 13-17.
2. Discuss methods of inspecting and preparing the work area.
3. Instruct the students in outlining the work area.
4. Instruct the students in positioning and unrolling the base sheet.
5. Instruct the students in safety rules when cutting and trimming the base sheet.
6. Discuss the care and maintenance of tools.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 19

CRITERION-REFERENCED MEASURE

Questions

1. Before nailing the base sheet, the _________ specifications must be read and interpreted.
2. A _________ is used to carry galvanized fasteners.
3. Galvanized fasteners are _________ according to the manufacturer's specifications.

Answers

1. Manufacturer's
2. Nail apron
3. Spaced

Practical Application

Have the students nail a base sheet. The base sheet must not have tears or fishmouths and fasteners must be spaced according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist Performance Objective 19 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 19

NAILING A BASE SHEET

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined starting point and laydown pattern.		
4. Outlined the work area by chalkline.		
5. Positioned base sheet materials near starting point.		
6. Unrolled base sheet in strips, cut to length.		
7. Positioned base sheet according to laydown pattern and chalk line.		
8. Laid base sheet over the center drain, marked and cut the base sheet so drain could penetrate base sheet.		
9. Reviewed manufacturer's specification for fastening.		
10. Fastened base sheet to deck, spaced fasteners according to manufacturer's specifications.		
11. Trimmed and cut base sheet to fit.		
12. Repeated items 6 through 11 until work area was covered.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 19

NAILING A BASE SHEET

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Checked work area for tears, fishmouths and fastener spacing.		
14. Made adjustments.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 20

TASK

Prime the substrate.

STANDARD OF PERFORMANCE OF TASK

Primer must be uniformly applied with no heavy or light concentrations; there must be no voids in the primed substrate.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Hopper
Job specifications
Manufacturer's directions
Mop cart
Mops
Priming machine
Rollers
Water buckets

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use priming machine.
3. Select and apply primer.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Bitumen Application, p. 12.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Bitumen Application**, p. 12.
2. Discuss methods of inspecting and preparing the work area.
3. Instruct the students in estimating amount of primer needed.
4. Have the students read and discuss manufacturer's directions.
5. Direct the students in setting up and using priming machine.
6. Direct the students in setting up and using roller/mop priming.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 20

CRITERION-REFERENCED MEASURE

Questions

1. The primer should be mixed according to the _________ directions.
2. When applying the primer with the priming machine, the spray nozzle should be adjusted to a uniform mist that covers approximately _______ to _______ inches when applied.
3. When applying the primer with a roller/mop, work a _______ foot strip at a time.

Answers

1. Manufacturer's
2. 12, 18
3. Two (2)

Practical Application

Have the students prime the substrate. The primer must be uniformly applied with no heavy or light concentrations; there must be no voids in the primed substrate.

Method of Evaluating Practical Application

Use Checklist Performance Objective 20 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 20

PRIMING THE SUBSTRATE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined amount and type of primer to be used.		
4. Determined starting point and application pattern for priming operations.		
5. Mixed primer according to manufacturer's directions.		
6. a. Machine priming (1) Loaded primer into priming machine applicator. (2) Started priming machine. (3) Adjusted spray nozzle on priming applicator to desired spray, a uniform mist that covered approximately 12" - 18" when applied. (4) Continued spraying operations starting at the predetermined pattern using left/right motions holding the spray applicator approximately 12" - 18" above the substrate. (5) Continued pattern until substrate was completely primed.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 20

PRIMING THE SUBSTRATE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
b. Roller/mop priming (1) Loaded primer into hopper. (2) Saturated roller/mop with primer. (3) Applied primer by roller/mop to the starting area working a two foot strip from front to back. (4) Repeated items 2 and 3 making sure one strip overlapped the next until substrate was completely and uniformly primed.		
7. Checked work area for voids and uniformly primed.		
8. Made adjustments.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 21

TASK

Scratch gravel.

STANDARD OF PERFORMANCE OF TASK

Gravel must be completely removed without damage to felt or deck.

SOURCE OF STANDARD

Roofers' Local #20. **Joint Apprenticeship Program**, p. 2.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Gloves
Job specifications
Mechanical scratcher
Safety glasses
Spud bar
Square shovel
Upright broom
Wheelbarrow

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use mechanical scratcher.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Bitumen Application, pp. 28-30.

TEACHING ACTIVITIES

1. Have the students discuss **Owens-Corning Fiberglass Products, Bitumen Application**, pp. 28-30.
2. Discuss methods of inspecting and preparing the work area.
3. Discuss methods of removing scratched gravel.
4. Instruct the students in using the mechanical scratcher.
5. Discuss establishing patterns.
6. Discuss inspecting the work area to ensure that all of the area has been scratched.
7. Discuss the care and maintenance of foods and equipment.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 21

CRITERION-REFERENCED MEASURE

Questions

1. When removing scratched gravel, a ___________ scratcher can be used.
2. A ____________________ is used to pry gravel upward.
   a. Claw hammer
   b. Upright broom
   c. Spud bar
   d. Square shovel
3. Dust and debris are removed from a work area by using a/an _________ _________.

Answers

1. Mechanical
2. c
3. Upright broom

Practical Application

Have the students scratch gravel. The gravel must be completely removed without damage to felt or deck.

Method of Evaluating Practical Application

Use Checklist Performance Objective 21 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 21

SCRATCHING GRAVEL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined starting point and scratch pattern.		
4. Determined how to remove scratched gravel from the roof.		
5. Used a spud bar to force underneath gravel down to the felt and pried gravel upward.		
6. Started mechanical scratcher.		
7. Positioned mechanical scratcher over starting area and removed gravel according to removal pattern.		
8. Removed gravel according to established pattern. Worked the area covered by the scratcher. Repeated the process until all gravel had been scratched.		
9. Removed scratched gravel from roof.		
10. Broomed clean work area to remove dust and debris.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 21

SCRATCHING GRAVEL

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Inspected work area to insure all gravel had been scratched and no damage had been done to felt.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature   Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 22

TASK

Spread gravel by hand.

STANDARD OF PERFORMANCE OF TASK

Gravel must uniformly cover and be embedded in bitumen.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Gravel hopper
Job specifications
Rubber boots
Square shovel
Wheelbarrow

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Identify and use gravel hopper.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, Bitumen Application, pp. 10 and 28-31.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Bitumen Application**, pp. 10 and 28-31.
2. Discuss methods of inspecting and preparing the work area.
3. Direct the students in determining the starting point and laydown pattern.
4. Instruct the students in determining amount of gravel required.
5. Discuss using a shovel to spread gravel.
6. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 22

CRITERION-REFERENCED MEASURE

Questions

1. Gravel should be __________ grade and washed.
2. Gravel is first loaded into a __________ and then positioned in the starting area.
3. At least ______ lbs./100 ft^2. of gravel should be embedded in bitumen.

Answers

1. Commercial
2. Wheelbarrow
3. 400

Practical Application

Have the students spread gravel by hand. The gravel must uniformly cover and be embedded in bitumen.

Method of Evaluating Practical Application

Use Checklist Performance Objective 22 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 22

SPREADING GRAVEL BY HAND

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined starting point and laydown pattern.		
4. Determined amount of gravel required.		
5. Stockpiled gravel in the work area.		
6. Loaded wheelbarrow with gravel and positioned it in the starting area.		
7. Loaded shovel with gravel and used a swinging motion, also tipped the shovel (left or right), and threw gravel on the bitumen.		
8. Worked small sweeping arcs the size of which depended on the size and load of the shovel.		
9. When spreading gravel over a new area, spread lightly the first time to insure that gravel was embedded in the bitumen; avoided pile-ups.		
10. Worked according to the laydown pattern.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 23

TASK

Spread gravel by machine.

STANDARD OF PERFORMANCE OF TASK

Gravel must uniformly cover and be embedded in the bitumen.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook.**

CONDITIONS FOR PERFORMANCE OF TASK

Gravel hopper
Gravel spreader
Job specifications
Rubber boots
Square shovel
Wheelbarrow

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use gravel spreader.
3. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products. **Bitumen Application**, pp. 10 and 28-31.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products, Bitumen Application,** pp. 10 and 28-31.
2. Discuss methods of inspecting and preparing the work area.
3. Direct the students in determining starting point and laydown pattern.
4. Instruct the students in determining the amount of gravel required.
5. Discuss using the gravel spreader.
6. Discuss the care and maintenance of tools.
7. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 23

CRITERION-REFERENCED MEASURE

Questions

1. After determining the amount of gravel needed, the gravel may be ___________ in the work area.
2. The first layer of gravel should be checked to insure _________ coverage and that the gravel is embedded in the ___________.
3. ___________________ should be worn when spreading gravel.

Answers

1. Stockpiled
2. Uniform, bitumen
3. Rubber boots

Practical Application

Have the students spread gravel by machine. The gravel must uniformly cover and be embedded in the bitumen.

Method of Evaluating Practical Application

Use Checklist Performance Objective 23 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 23

SPREADING GRAVEL BY MACHINE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined starting point and laydown pattern.		
4. Determined the amount of gravel required.		
5. Stockpiled gravel in the work area.		
6. Loaded gravel in the gravel spreader.		
7. Started gravel speader machine.		
8. Initiated gravel spreading operations according to laydown pattern.		
9. Repeated spreading process until work area was completely and uniformly covered with gravel.		
10. Checked work area for voids, uniform coverage, and insured that gravel was embedded in bitumen.		
11. Made adjustments.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 24

TASK

Start built-up roof at an eave.

STANDARD OF PERFORMANCE OF TASK

Built-up must have no buckles or fishmouths; ply must be laid and aligned according to manufacturer's specifications.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Dry sheet (building paper)
Felt, 15#
Felt, 30#
Galvanized fasteners
Gloves
Hot bitumen
Job specifications
Mop
Mop cart
Roofer's knife
Rubber boots
Safety glasses
Scaffold
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications and manufacturer's specifications.
2. Identify and select 15# and 30# felt paper.
3. Identify and select galvanized fasteners.
4. Erect and use scaffold.
5. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 20, 32-66.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products**, pp. 20, 32-66.
2. Discuss methods of inspecting and preparing the work area.

TEACHING ACTIVITIES (Continued)

3. Instruct the students in erecting scaffolds.
4. Discuss methods of starting built-up roofs at the eave.
5. Discuss safety rules when applying hot bitumen.
6. Instruct the students on safety rules when cutting felt.
7. Discuss the care and maintenance of tools and equipment.
8. Have the students complete the performance steps of the task.

CRITERION-REFERENCED MEASURE

Questions

1. The two kinds of felt paper used on a built-up roof are _______ and _______.
2. When starting from the edge, a _______ strip of _______ felt should be cut.
3. When fastening felt to the roof, nails should be positioned at least _______ inch(es) from the edge.

Answers

1. 15#, 30#
2. 16", 30#
3. One

Practical Application

Have the students start a built-up roof at an eave. The built-up roof must have no buckles or fishmouths; the ply must be laid and aligned according to the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist Performance Objective 24 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 24

STARTING A BUILT-UP ROOF AT AN EAVE

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications.		
3. Inspected and prepared work area.		
4. Erected scaffolds.		
5. Determined starter ply requirements.		
6. Outlined pattern for laydown.		
7. Loaded the roof.		
8. Laid dry sheet parallel to the eaves; allowed for a 2" lap of edges. Spot nailed to maintain position.		
9. Cut a 16" strip of 30# felt and laid it along the eaves. Nailed in place. Positioned nails at least one inch from edge of the eaves and spaced approximately one foot apart.		
10. Applied hot bitumen to felt.		
11. Measured and cut a full length strip of 15# felt and placed on top of binder allowing for a 14" exposure.		
12. Continued laying the 30# felt with an overlap of 2" and covered with a binder.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 24

STARTING A BUILT-UP ROOF AT AN EAVE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Continued laying 15# felt on top of 30# felt maintaining the 14" exposure, embedding it in the binder.		
14. Repeated items 12 and 13 until work area was started.		
15. Walked and broomed felt to remove buckles and fishmouths.		
16. Checked work area for alignment, buckles and fishmouths.		
17. Made adjustments.		
18. Cleaned work area.		
19. Cleaned tools and equipment.		
20. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature

Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 25

TASK

Underlay felt by hand.

STANDARD OF PERFORMANCE OF TASK

Felt must lie flat, extend beyond the rake or eaves, overlap by two inches, and be fastened to deck.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Nail apron
Roofer's hatchet
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and select galvanized fasteners.
3. Identify and use measuring tape.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 13, 20, 28-35.

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products**, pp. 13, 20, 28-35.
2. Discuss methods of inspecting and preparing the work area.
3. Discuss the different laydown patterns.
4. Discuss safety rules when cutting felt.
5. Discuss the care and maintenance of tools.
6. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 25

CRITERION-REFERENCED MEASURE

Questions

1. When laying felt by hand, felt must be laid __________.
2. What is the chalk line used for in this type of work?
3. When laying felt on a roof, it must extend beyond the __________ or __________.

Answers

1. Flat
2. To make a straight line.
3. Rake or eaves

Practical Application

Have the students underlay felt by hand. The felt must lie flat, extend beyond the rake or eaves, overlap by two inches, and be fastened to the deck.

Method of Evaluating Practical Application

Use Checklist Performance Objective 25 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 25

UNDERLAYING FELT BY HAND

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Laid out chalk lines to determine horizontal or vertical laydowns.		
4. Measured and cut felt to fit.		
5. Positioned and secured felt inside and aligned with chalk lines; allowed at least a 2" overlap.		
6. Trimmed rake and eave ends.		
7. Laid out patterns for vertical and horizontal tie-ins.		
8. Repeated items 3 through 7 until work area was covered.		
9. Checked area to insure felt was lying flat, overlapped, and fastened to the deck.		
10. Made adjustments.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 26

TASK

Underlay felt by machine.

STANDARD OF PERFORMANCE OF TASK

Felt must be secured to the deck, must have no fishmouths or wrinkles, and must be aligned with layout lines with a two inch overlap.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Felt layer
Galvanized fasteners
Job specifications
Push broom
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify and use a felt layer machine.
3. Identify and select galvanized fasteners.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 10, 20, 28-35

TEACHING ACTIVITIES

1. Have the students read and discuss **Owens-Corning Fiberglass Products**, pp. 10, 20, 28-35.
2. Discuss methods of inspecting and preparing the work area.
3. Discuss the different laydown patterns.
4. Discuss safety rules when using a felt layer machine.
5. Instruct the students in loading the felt layer machine.
6. Discuss methods of inspecting the work area.
7. Discuss the care and maintenance of tools.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 26

CRITERION-REFERENCED MEASURE

Questions

1. There are two methods of laying down felt. One is by __________, and the other is by __________.
2. Felt must be aligned with layout lines with a (an) ________ inch overlap.
3. After laying down felt, it should be free of __________ or __________.

Answers

1. Machine, hand
2. Two
3. Fishmouths, wrinkles

Practical Application

Have the students underlay felt by machine. The felt must be secured to the deck, must have no fishmouths or wrinkles, and must be aligned with layout lines with a two inch overlap.

Method of Evaluating Practical Application

Use Checklist Performance Objective 26 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 26

UNDERLAYING FELT BY MACHINE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined starting point and laydown pattern.		
4. Laid out chalk lines to determine horizontal and vertical tie-ins.		
5. Loaded the machine with felt.		
6. Positioned machine at starting point; adjusted machine according to number of plies specified.		
7. Started machine, pulled/pushed felt from the roll, laid down felt, and aligned with layout lines.		
8. Fastened felt to deck.		
9. Walked, broomed felt down.		
10. Repeated items 5 through 9 until felt covered the work area.		
11. Shut off felt layer.		
12. Checked work area for alignment, wrinkles, fishmouths and overlap.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 26

UNDERLAYING FELT BY MACHINE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature

Date

DUTY APPLYING SURFACE MATERIALS

PERFORMANCE OBJECTIVE 27

TASK

Waterproof a wooden deck.

STANDARD OF PERFORMANCE OF TASK

Deck must not leak; the contour of the deck must be maintained with no protruding nails or wrinkles.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Garden hose
Job specifications
Resin paper
Roofer's hatchet
Roofer's knife
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications and manufacturer's specifications.
2. Identify and select galvanized fasteners.
3. Identify and select resin paper.
4. Demonstrate safe work practices.

RESOURCE

Owens-Corning Fiberglass Products, pp. 11-12.

TEACHING ACTIVITIES

1. Have the students read **Owens-Corning Fiberglass Products**, pp. 11-12.
2. Discuss methods of inspecting and preparing the deck.
3. Discuss the different laydown patterns.
4. Instruct the students in unrolling resin paper.
5. Discuss safety rules when cutting resin paper.
6. Instruct the students in fastening resin paper to the deck.
7. Discuss the care and maintenance of tools.
8. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 27

CRITERION-REFERENCED MEASURE

Questions

1. When waterproofing a wooden deck, the deck must not __________.
2. __________ paper is used in waterproofing a wooden deck.
3. The pattern of fastening must comply with the ____________ ____________.

Answers

1. Leak
2. Resin
3. Manufacturer's specifications

Practical Application

Have the students waterproof a wooden deck. The deck must not leak; the contour of the deck must be maintained with no protruding nails or wrinkles.

Method of Evaluating Practical Application

Use Checklist Performance Objective 27 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 27

WATERPROOFING A WOODEN DECK

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared the deck.		
3. Determined starting point and laydown pattern.		
4. Chalked layout lines.		
5. Unrolled resin paper and aligned with laydown lines. Laid down paper; cut to fit.		
6. Repeated item 5 until deck was completely covered with resin paper. Allowed 2" overlap for strips.		
7. Using the same pattern and procedures in items 5 and 6, placed strips of base sheet on top of the resin paper. Allowed a 2" overlap for each successive strip.		
8. Fastened the materials to the deck.		
9. Checked work area for wrinkles and protruding nails, and made sure that materials conformed to the contours of the roof.		
10. Checked for leaks.		
11. Repaired leaks.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 27

WATERPROOFING A WOODEN DECK

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

FLASHING/SEALING JOINTS

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 28

TASK

Flash a chimney.

STANDARD OF PERFORMANCE OF TASK

Flashing must fit tightly around chimney, all laps must be vertical, and flashed areas must not leak.

SOURCES OF STANDARD

Johnson. **Roofer's Handbook**, pp. 60-64.
Reed. **Residential Carpentry**, p. 363.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 176.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Cold chisel
Flat hand trowel
Galvanized fasteners
Job specifications
Measuring tape
Putty knife
Roofer's hatchet
Roofer's knife
Roofing cement
Spud bar
Tin snips

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurement of length using a carpenter rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 241-242.
2. Baker. **Carpentry Fundamentals**, pp. 192-194.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 241-242 and **Carpentry Fundamentals**, pp. 192-194.
2. Explain the purpose for cleaning out (scratching out) mortar joints.

PERFORMANCE OBJECTIVE 28

TEACHING ACTIVITIES (Continued)

3. Explain the types of flashing materials needed to perform job.
4. Illustrate the completed flashed chimney.
5. List tools needed to flash chimney.
6. Describe how to estimate cost of material and labor for flashing a chimney.
7. Prepare handouts showing a chimney before and after flashing.
8. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. __________ and __________ are two types of materials used for flashing.
2. The flashing should be set into the mortar joints to a depth of __________.
3. Chimney flashing is divided into two parts; what are these parts called?

Answers

1. Sheet metal and 90 lbs. mineral surface rolled roofing.
2. One and one half inches (1 1/2").
3. Base and cap flashing.

Practical Application

Have the students flash a chimney so that flashing will fit tightly, all laps must be vertical, and flashed areas must not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 28 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 28

FLASHING A CHIMNEY

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured height, width, and length of area to be flashed.		
4. Measured cut; attached a cant strip at intersection of chimney and roof.		
5. Insured roofing materials overlapped cant strip by at least 12". Overlap should be folded up the face of chimney.		
6. Positioned and bent base flashing to fit juncture of roof and chimney on three sides.		
7. Measured and cut cap flashing material to fit; allowed for a 4" minimum overlap at joints and at mortar.		
8. Cleaned out mortar joints to at least 2".		
9. Installed precut cap flashing into mortar joints and refilled mortar joint with roofing cement.		
10. Fitted base flashing under cap flashing.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 28

FLASHING A CHIMNEY

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Applied sealer to top of flashing.		
12. Trimmed excess flashing and sealant.		
13. Checked flashing for fit, vertical laps.		
14. Tested for leaks. Note: After sealant has dried, spray water over the flashed area to determine if flashing is watertight.		
15. Made adjustments.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 29

TASK

Flash a cricket (saddle).

STANDARD OF PERFORMANCE OF TASK

Flashing must be overlapped at least 2" and flashed areas must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 62.
Reed. **Residential Carpentry**, p. 361.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Plastic sealant
Putty knife
Roofer's knife
Roofing cement
Soldering kit
Spud bar
Tin snips

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Baker, et al. **Carpentry Fundamentals**, p. 192.
2. Wagner. **Modern Carpentry**, p. 242.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry Fundamentals**, p. 192 and **Modern Carpentry**, p. 242.
2. Explain the purpose of cricket (also known as saddle).
3. Explain the types of materials used to flash a cricket (saddle).

TEACHING ACTIVITIES (Continued)

4. Illustrate a completed flashed cricket (saddle).
5. Prepare handouts of cricket (saddle).
6. Explain how to estimate the cost of material and labor for flashing a cricket (saddle).
7. List tools needed to flash cricket (saddle).
8. Organize a field trip, for purpose of seeing a cricket (saddle).
9. Have the students complete the performance of the tasks.

CRITERION-REFERENCED MEASURE

Questions

1. Chimneys on sloping roofs generally require an auxiliary roof deck called a (an) ________.
2. A small __________ could be constructed of triangular pieces of ________.
3. A (an) __________ is usually covered with ____________________ sheet metal.

Answers

1. Cricket (saddle)
2. Cricket (saddle), 3/4" exterior plywood.
3. Cricket (saddle), corrosion-resistant.

Practical Application

Have the students flash a cricket (saddle) so that flashed area will be waterproof. Flashing must be overlapped at least 2 inches.

Method of Evaluating Practical Application

Use Checklist Performance Objective 29 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 29

FLASHING A CRICKET (SADDLE)

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured area to be flashed.		
4. Measured, cut and layed out flashing materials.		
5. Positioned base flashing under shingles at least 12" with a 4" overlap on the wall.		
6. Measured and cut cap flashing material.		
7. Cleaned out mortar joints to at least 2" and attached cap flashing into mortar joints, bending the flashing down against wall and overlapping base flashing.		
8. Refilled mortar joints with roofing cement. Note: If a galvanized saddle flashing is available, solder cap to galvanized saddle.		
9. Applied plastic sealant on all joints.		
10. Checked work area for laps, voids.		
11. Made adjustments.		
12. Tested for leaks.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 29

FLASHING A CRICKET (SADDLE)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 30

TASK

Flash a hip/ridge with metal.

STANDARD OF PERFORMANCE OF TASK

Flashing must cover the hip/ridge and conform to the contour of the hip/ridge; flashing must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 62.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 178.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Roofing cement
Spud bar
Tin snips
Water hose

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Feirer, et al. **Carpentry and Building Construction**, (revised), p. 549.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction,** (revised), p. 549.
2. Explain the purpose of hip/ridge flashing.
3. Explain the different types of hip/ridge flashing.
4. Explain how to bend or shape flashing to conform to hip/ridge pitch.
5. Explain and demonstrate nailing procedure for hip/ridge metal.
6. Explain how to apply roofing cement to jointed seams.
7. Have students estimate cost of labor and materials for hip/ridge flashing.
8. Prepare handouts showing a flashed metal hip/ridge.
9. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 30

CRITERION-REFERENCED MEASURE

Questions

1. What is the minimum width that the metal should be cut to flash a hip/ridge?
2. What is the nailing order for fastening hip/ridge metal?
3. What is the overlap when more than one piece of metal is used?

Answers

1. 20"
2. One side and then the other until complete.
3. Minimum 2".

Practical Application

Have the students flash a hip/ridge with metal so the flashing will conform to the contour of roof and will not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 30 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 30

FLASHING A HIP/RIDGE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared hip/ridge area for flashing.		
3. Measured hip/ridge.		
4. Measured cut, trimmed metallic flashing to fit hip/ridge. Cut strip of metal at least 20" wide and as long as the hip/ridge. If more than one length is required, include a 2" overlap at the seams.		
5. Crimped flashing to conform to the shape of the hip/ridge.		
6. Positioned metal flashing on the hip/ridge and completed bending process to conform to contour of roof.		
7. Fastened flashing to the hip/ridge. Nailed one side of the hip/ridge, then the other side, paying particular attention to the hip/ridge contour.		
8. Continued items 6 and 7 until hip/ridge was completely flashed.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 30

FLASHING A HIP/RIDGE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Continued the fastening process on the other side.		
10. Applied roofing cement to seams.		
11. Checked the hip/ridge flashing for contour.		
12. Made adjustments.		
13. Tested for leaks by spraying flashed area with hose.		
14. Eliminated leaks by inserting more fasteners or sealant.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 31

TASK

Flash a hip/ridge for roll roofing.

STANDARD OF PERFORMANCE OF TASK

Flashing must be bonded to the underbed with no rips; hip/ridge flashing must be waterproof.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, p. 361.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Claw hammer
Galvanized fasteners
Garden hose
Job specifications
Measuring tape
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 236-237.
2. Baker, et al. **Carpentry Fundamentals**, pp. 202-203.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 236-237 and **Carpentry Fundamentals**, pp.202-203.
2. Explain different types of hip/ridge flashing.
3. Explain how to cut rolled roofing for hip/ridge flashing.
4. Have the students practice cutting scrap pieces of rolled roofing.
5. Explain the possible causes of leaks when applying rolled roofing to hip/ridge.
6. Explain how to apply roofing cement to rolled roofing on a hip/ridge.

PERFORMANCE OBJECTIVE 31

TEACHING ACTIVITIES (Continued)

7. Have students estimate cost of labor and material for roll roofing hip/ridge flashing.
8. Explain the purpose of hip/ridge flashing.
9. Prepare handouts showing a flashed roll roofing hip/ridge.
10. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Bonding agents should be applied to the __________ of ridge roll roofing.
2. What is the correct width flashing should be cut?
   a. 2"
   b. 10"
   c. 12"
   d. 16"
3. What three items should be checked after installation?

Answers

1. Underbed
2. c
3. Bonding, rips, and fit

Practical Application

Have the students do a hip/ridge for roll roofing so that flashing will be bonded to underbed with no rips and be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 31 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 31

FLASHING A HIP/RIDGE FOR ROLL ROOFING

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared the hip/ridge for flashing.		
3. Measured and cut 12" wide strips of roll roofing of sufficient length to cover the hip/ridge. Note: Where more than one length of roll roofing is required use at least a 2" overlap at the seams.		
4. Positioned strips of roll roofing on the hip/ridge; trimmed to fit.		
5. Applied agent to the underside of the flashing.		
6. Replaced flashing strip on hip/ridge. Applied pressure to bond strips to underbed.		
7. Repeated item 6 until entire hip/ridge was flashed, allowing at least a 2" overlap at seams.		
8. Fastened down overlap from flashing at the eaves.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 31

FLASHING A HIP/RIDGE FOR ROLL ROOFING

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Checked flashings for bonding, rips, and fit.		
10. Trimmed and adjusted as necessary.		
11. Tested for leaks.		
12. Eliminated leaks.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 32

TASK

Flash a parapet.

STANDARD OF PERFORMANCE OF TASK

Flashing must be bonded to wall, all laps must be vertical, and parapet must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 61.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Claw hammer
Galvanized fasteners
Garden hose
Job specifications
Measuring tape
Mop
Mop cart
Pointing trowel
Roofer's hatchet
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Feirer, et al. **Carpentry and Building Construction**, (revised), p. 549.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction**, pp. 548-549, figure 35-59.
2. Explain the purpose of a parapet.
3. Describe materials needed to flash a parapet.
4. Have students estimate materials needed to flash a parapet to length given.
5. Explain the correct way to apply bonding agent.

PERFORMANCE OBJECTIVE 32

TEACHING ACTIVITIES (Continued)

6. Prepare handouts showing a parapet wall before and after flashing.
7. Identify the tools needed to flash a parapet.
8. Explain the procedure for correctly flashing a parapet.
9. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Give a brief definition of a parapet.
2. Give the allowance for overlap from nailer: ______,top, ______ bottom.
3. To flash a parapet correctly, how many pieces of flashing will be needed?
    a. 1
    b. 2
    c. 3
    d. 4

Answers

1. A low wall or rail at edge of roof.
2. 1/2", 3"
3. b.

Practical Application

Have the students flash a parapet so the flashing is bonded to the wall, laps are vertical, and it will be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 32 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 32

FLASHING A PARAPET

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared area to be flashed.		
3. Measured and cut two sets of flashing materials to fit. Note: If overlaps are necessary, allowed for at least a 2" overlap at seams.		
4. Positioned flashing materials and trimmed to fit.		
5. Applied bonding agent to wall.		
6. Applied bonding agent to underside of one set of flashing.		
7. Positioned flashing materials against wall.		
8. Continued with items 4, 5, 6, and 7 until work area was completely covered by flashing.		
9. Covered first layer of flashing with bonding agent.		
10. Rolled second set of flashing materials over the first set using same procedures as in items 6 and 7 until flashed area was covered. Note: On the vertical allow at least 1/2" overlap from the nailor (top) and a 3" overlap below the cant (bottom).		

CHECKLIST FOR PERFORMANCE OBJECTIVE 32

FLASHING A PARAPET

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Topped trowel to finish.		
12. Checked work area to insure bonding and vertical seams.		
13. Made adjustments.		
14. Tested for leaks.		
15. Eliminated leak areas.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 33

TASK

Flash a ring drain.

STANDARD OF PERFORMANCE OF TASK

Flashing must be folded into the drain; there must be no fishmouths; the snap ring must be installed; ring drain must be waterproof.

SOURCES OF STANDARD

Johnson. **Roofer's Handbook,** p. 64.
U.S. Department of Agriculture. **Simple Home Repairs....Outside**, p. 14.
Readers' Digest Association. **Complete Do-It-Yourself Manual,** p. 178.

CONDITIONS FOR PERFORMANCE OF TASK

Bitumen
Bonding agent
Claw hammer
Garden hose
Gloves
Hot lugger
Job specifications
Lead prime
Pliers
Pointing trowel
Putty knife
Roofing lead
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students discuss **Teacher Information Sheet** for flashing a ring drain.
2. Explain purpose of flashing a ring drain.
3. Illustrate a completed flashed ring drain.
4. List tools needed to flash a ring drain.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 33

CRITERION-REFERENCED MEASURE

Questions

1. The snap ring should be ________ into the bitumen.
2. _________________ will be applied to the inside of ring and pipes.
3. A ________ overlap should be flattened inside of ring drain hole.

Answers

1. Sealed
2. Lead Prime
3. 3"

Practical Application

Have the students flash a ring drain so that flashing will be folded into drain and there will be no fishmouth; ring drain must be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 33 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 33

FLASHING A RING DRAIN

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared ring drain area for flashing.		
3. Applied bonding agent around ring drain, used small circle wide enough to cover the diameter of the ring.		
4. Positioned lead ring on top of drain, applied lead prime to inside ring and pipe prior to final positioning.		
5. Slid ring down pipe until it was flush with the roof. Insured lead sleeve was still over drain pipe opening.		
6. Flattened edges of the lead sleeve inside ring drain hole. Insured at least a 3" overlap.		
7. Top coated the stripping materials with bitumen. Caution: USED EXTREME CAUTION AND PROTECTIVE CLOTHING WHEN APPLYING HOT BITUMEN.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 33

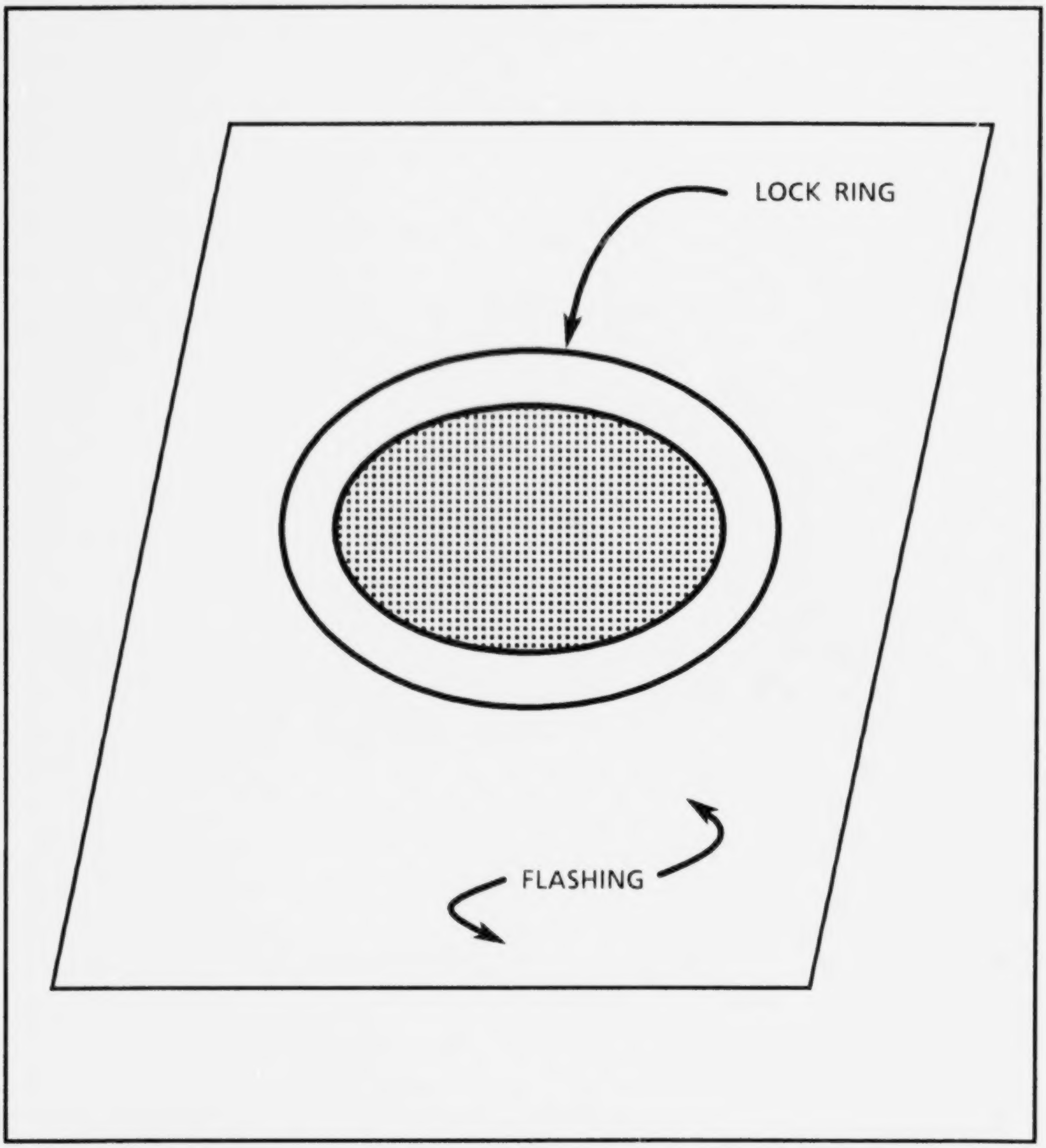
FLASHING A RING DRAIN

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Installed snap ring; applied pressure to seal it in the bitumen.		
9. Checked work area for fishmouths; snap ring and flashing folded into drain.		
10. Made adjustments.		
11. Tested for leaks.		
12. Eliminated leaks.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

TEACHER INFORMATION SHEET (P.O. #33)


LOCK RING
FLASHING

CARPENTER TO FLASH OVER THE MATERIAL WHEN THE ROOFING MATERIAL IS INSTALLED.

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 34

TASK

Flash a roof drain (lead).

STANDARD OF PERFORMANCE OF TASK

Drain must not contain fishmouths, lead must be folded into drain, and roof drain must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook,** p. 64.
U.S. Department of Agriculture. **Simple Home Repairs...Outside,** p. 14.
Readers' Digest Association. **Complete Do-It-Yourself Manual,** p. 178.
Roofers' Local #20. **Joint Apprenticeship Program,** p. 7.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Garden hose
Gloves
Job specifications
Lead roofing
Mop
Mop cart
Pliers
Pointing trowel
Putty knife
Roofer's hatchet
Roofer's knife
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurement of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Smith. **Principles and Practices of Light Construction,** pp. 155-157.

TEACHING ACTIVITIES

1. Have the students read and discuss **Principles and Practices of Light Construction,** pp. 155-157.
2. Explain purposes of having a roof drain (lead).

PERFORMANCE OBJECTIVE 34

TEACHING ACTIVITIES (Continued)

3. Prepare handouts showing a roof drain placed on a roof.
4. Explain how the flashing is to be installed along edge of roof.
5. Explain a scupper box and how it is used as a roof drain (lead).
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. An overlap of __________ at the seam will be allowed on flashing materials.
2. An overlap of __________ will be allowed on felt around lead boot.
3. To install a scupper box a section of ______________________ must be removed at edge of roof.

Answers

1. 2"
2. 6"
3. Cant strip

Practical Application

Have the students flash a roof drain with lead. Lead must be folded into drain and be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 34 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 34

FLASHING A ROOF DRAIN (LEAD)

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared roof drain area for flashing.		
3. Measured and cut flashing materials to fit. Allowed overlap for seams.		
4. Applied bonding agent around roof drain area; followed contour of drain when applying bonding agent.		
5. Positioned flashing materials in bonding, pressing firmly to insure bonding.		
6. Contoured flashing material to drain and roof.		
7. Positioned felt so as to surround the lead boot, allowing at least a 6" overlap for felt.		
8. Top mop felt.		
9. Bent lead overlap into and against inside drain; allowed for a 3" overlap on the lead.		
10. Checked work area for fishmouths and laps.		
11. Made adjustments.		
12. Tested for leaks.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 34

FLASHING A ROOF DRAIN (LEAD)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Eliminated leaks.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 35

TASK

Flash a skylight with membrane.

STANDARD OF PERFORMANCE OF TASK

Flashing must not be wrinkled nor contain voids; skylight must be waterproof.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Job specifications
Measuring tape
Putty knife
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCE

Watson. **Construction Material and Processes,** pp. 247-249.

TEACHING ACTIVITIES

1. Have the students read and discuss **Construction Material and Processes,** pp. 247-249.
2. Have the students read job specifications.
3. Prepare handout(s) of skylight before and after membrane has been applied.
4. Have the students practice cutting flashing with roofer's knife.
5. Have the students practice applying bonding agent so that when applying to skylight it will be neat.
6. Have the students estimate cost of labor and material to flash a skylight with membrane.
7. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 35

CRITERION-REFERENCED MEASURE

Questions

1. Use sufficient __________ to insure bonding of membrane.
2. Flashing must be free of __________ and __________.
3. What is used around skylight and flashing to insure that no leak will occur?

Answers

1. Pressure
2. Wrinkles and voids
3. Bonding agent

Practical Application

Have the students flash a skylight with membrane without wrinkles or voids and be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 35 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 35

FLASHING A SKYLIGHT WITH MEMBRANE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared skylight area for flashing.		
3. Measured and cut flashing materials to fit.		
4. Positioned flashing materials around skylight.		
5. Applied bonding agent around the skylight; applied sufficient bonding agent to cover flashing materials.		
6. Positioned and pressed flashing materials in place. Used sufficient pressure to insure bonding.		
7. Trimmed flashing for final fit.		
8. Checked flashing for wrinkles and voids.		
9. Made adjustments.		
10. Tested for leaks.		
11. Eliminated leaks.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 36

TASK

Flash a valley with metal.

STANDARD OF PERFORMANCE OF TASK

Flashing must be fastened to the deck; overlaps must be 2"; valley must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook,** p. 60.
Reed. **Residential Carpentry,** p. 363.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Garden hose
Job specifications
Length of 2x4
Measuring tape
Metallic fasteners
Roofer's knife
Tin snips
Wood block

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurement of length using a tape measure.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry,** p. 250.
2. Feirer, et al. **Carpentry and Building Construction,** pp. 541-542.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry,** p. 250 and **Carpentry and Building Construction,** pp. 541-542.
2. Explain the purpose of flashing a valley with metal.
3. Explain the proper way to bend metal for valley flashing.
4. Have the students practice making bends in scrap metal flashing.
5. Prepare a handout showing a flashed valley with metal.
6. List the tools needed to flash a valley with metal.
7. Explain how to install cleats along edge of flashing.
8. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 36

CRITERION-REFERENCED MEASURE

Questions

1. Name two types of metal flashing used for a valley.
2. Give the minimum from center of valley the metal should extend.
3. Cleats should be placed at least ________ apart.

Answers

1. Copper and aluminum
2. 7"
3. 2'

Practical Application

Have the students flash a valley with metal so that metal is flat to deck with 2" overlaps; valley must be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 36 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 36

FLASHING A VALLEY WITH METAL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared valley to be flashed.		
3. Measured valley length and width.		
4. Measured and cut flashing materials to fit; allowed for a 2" overlap at the seams if more than one length was required.		
5. Positioned and bent metal to fit the contour of the valley. NOTE: A 2x4 was used to help make the bends. A wood block was used to complete the bend.		
6. Bent the last one inch of the outer edge of the flashing 90° away from the roof.		
7. Positioned and attached flashing cleats along each side, the length of the flashing; cleats were spaced at least two feet apart.		
8. Positioned cleat so the bend was in contact with the 1" 90° bend at the edge of the flashing material. Extended bend at least 1/2" over the bend in the flashing. NOTE: Insured cleats were made of same metal as flashing.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 36

FLASHING A VALLEY WITH METAL

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Bent the bond of cleat forward over raised edge of flashing to lock flashing into bend; then bent again until the cleat and the flashing lay flat. Repeated the process for all cleats laying.		
10. Bent the metal flap over the attached cleat fasteners (see item 7).		
11. Checked flashing for security and laps.		
12. Made adjustments.		
13. Tested for leaks.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature　　　　　　　　Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 37

TASK

Flash a valley with roll roofing.

STANDARD OF PERFORMANCE OF TASK

Flashing must be fastened to subsurface, must have a "foot" overlap at seams, and must be waterproof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 103.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Chalk line
Claw hammer
Galvanized fasteners
Garden hose
Job specifications
Measuring tape
Roofer's hatchet
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall the measurements of length using a carpenter's rule.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, p. 236.
2. Baker. **Carpentry Fundamentals**, p. 183.
3. Feirer. **Carpentry and Building Construction**, pp. 520-523.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, p. 236; **Carpentry Fundamentals**, p. 183; and **Carpentry and Building Construction**, pp. 520-523.
2. Explain the procedure for snapping a chalk line parallel to a valley.
3. Prepare handouts showing a flashed valley with roll roofing.
4. Explain the purpose for flashing a valley with roll roofing.

TEACHING ACTIVITIES (Continued)

5. Have the students estimate cost of labor and material for flashing a valley with roll roofing.
6. Organize a field trip for purpose of seeing a valley flashed with roll roofing.
7. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. How wide should starter strip of roll roofing be cut to flash a valley?
2. How wide should finish flashing for roll roofing be cut to complete task?
3. Flashing material should be the same __________ as shingles.

Answers

1. 12"
2. 24"
3. Color

Practical Application

Have the students flash a valley with roll roofing, flashing fastened to subsurface and having foot overlap at seams; it must be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 37 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 37

FLASHING A VALLEY WITH ROLL ROOFING

Student's Name Date

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared valley to be flashed.		
3. Snapped a chalk line parallel to the valley on each side, the length of valley.		
4. Snapped a parallel line, on each side 12" from center, for length of valley.		
5. Measured and cut a strip of roll roofing 12" wide and one foot longer than the valley; if more than one strip was necessary, allowed for a one "foot" overlap at the seams. NOTE: Flashing materials should be same color as shingles.		
6. Measured and cut a strip of roll roofing 24" wide and one foot longer than the valley; allowed for a one foot overlap if more than one strip was required.		
7. Positioned and fastened the 12" strip in the valley, aligned with the 12" chalklines, and overlapped seams by one foot.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 37

FLASHING A VALLEY WITH ROLL ROOFING

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Applied bonding agent to 12" strip.		
9. Pressed and bent strip to contour of valley; secured strip to subsurface.		
10. Positioned the 24" strip in the valley, aligned between 24" chalk lines, and overlapped seams by one foot.		
11. Repeated item 9.		
12. Trimmed for fine fit.		
13. Checked valley for overlap, and insured it was fastened.		
14. Made adjustments.		
15. Tested for leaks.		
16. Eliminated leaks.		
17. Cleaned work area.		
18. Cleaned tools and equipment.		
19. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 38

TASK

Flash a vent.

STANDARD OF PERFORMANCE OF TASK

Flashing must be firmly secure with no voids and must be waterproof.

SOURCES OF STANDARD

Johnson. **Roofer's Handbook**, p. 64.
U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 14.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 178.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Claw hammer
Galvanized fasteners
Garden hose
Job specifications
Measuring tape
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall the measurements of length using a carpenter rule.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, p. 243.
2. Baker. **Carpentry Fundamentals**, p. 182.

TEACHING ACTIVITIES

1. Read and discuss **Modern Carpentry**, p. 243; and **Carpentry Fundamentals**, p. 182.
2. Illustrate a flashed vent.
3. Prepare handouts showing various vents and how to flash each type.
4. Explain how to cut flashing to correct length for vent.
5. Explain the purpose of flashing a vent.
6. List tools needed to flash a vent.
7. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 38

CRITERION-REFERENCED MEASURE

Questions

1. The flashing should be large enough to extend at least __________ below, __________ above, and __________ on each side.
2. The vent should be placed over opening before or after shingles are laid.
3. What should be used to insure a good seal on vent flashing?

Answers

1. 4", 8", and 6"
2. After (beginning course)
3. Bonding agent

Practical Application

Have the students flash a vent so that flash is secure and free of voids and waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 38 to determine if the assignment was completed.

CHECKLIST FOR PERFORMANCE OBJECTIVE 38

FLASHING A VENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared vent area to be flashed.		
3. Measured vent for dimensions.		
4. Measured and cut flashing materials for vent.		
5. Insured upslope flashing material was at least 7" long.		
6. Positioned vent flashing making final trims and cuts.		
7. Applied bonding agent to the subsurface and to the underside of flashing materials.		
8. Placed vent flashing in position; pressed firmly to insure bonding.		
9. Fastened flashing materials along the top edge. NOTE: Used fasteners made of the same materials as the flashing.		
10. Applied bonding agent along top edge of the flashing and the subsurface to insure a good seal.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 38

FLASHING A VENT

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked flashing for security and voids.		
12. Made adjustments.		
13. Tested for leaks.		
14. Eliminated leaks.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY FLASHING/SEALING JOINTS

PERFORMANCE OBJECTIVE 39

TASK

Flash an expansion joint with membrane.

STANDARD OF PERFORMANCE OF TASK

Flashing must be fastened to the substructure with no fishmouths, must fit contour of roof, and must be waterproof.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Garden hose
Job specifications
Measuring tape
Mop
Mop cart
Pointing trowel
Roofer's knife
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCE

Watson. **Construction Materials and Processes**, pp. 241-245.

TEACHING ACTIVITIES

1. Have the students read and discuss **Construction Material and Processes**, pp. 241-245.
2. Have the students use dictionary to look up expansion joint and membrane, and discuss.
3. Explain job specifications for flashing an expansion joint with membrane.
4. Prepare handout(s) showing the expansion joint before and after membrane is installed.
5. Explain how to walk down or broom felt for proper binding.
6. Have the students practice walking down felt.
7. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 39

CRITERION-REFERENCED MEASURE

Questions

1. You must cut two strips of felt to cover expansion joint, and one must be __________ wider than the other.
2. To insure binding you must ______________________ or __________ felt.
3. A __________ overlap on the sides must be allowed for the membrane.

Answers

1. 4"
2. Walk down or broom
3. 4"

Practical Application

Have the students flash an expansion joint with a membrane. It must be fastened to the substructure with no fishmouths, must fit contour of roof, and must be waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 39 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 39

FLASHING EXPANSION JOINT WITH MEMBRANE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared expansion joint for flashing.		
3. Measured length and width of expansion joint.		
4. Cut two strips of felt to cover the expansion allowing for a 2" overlap at the seams if more than one length of felt was required.		
5. Applied bonding agent to the sides of the expansion joint. Strip mopped sufficient bonding agent to cover width of the smaller felt strip.		
6. Positioned the smaller felt strip in the bonding agent.		
7. Broomed or walked down felt to insure binding.		
8. Covered top of felt with bonding agent.		
9. Positioned and pressed larger strip over first strip of felt.		
10. Broomed or walked down felt.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 39

FLASHING EXPANSION JOINT WITH MEMBRANE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Cut roll membrane to length; allowed for a 4" overlap on the sides. Allowed 2" overlap at the seams if more than one length of membrane was required.		
12. Applied bonding agent to underside of the membrane and to top of second layer of felt.		
13. Positioned membrane on top of felt; applied pressure to insure bonding.		
14. Broomed membrane.		
15. Trimmed to fine fit.		
16. Checked flashing for fastening, fishmouths.		
17. Made adjustments.		
18. Tested for leaks.		
19. Eliminated leaks.		
20. Cleaned work area.		
21. Cleaned tools and equipment.		
22. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

INSTALLING SHINGLES

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 40

TASK

Cut starter course on "T" lock shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be nine inches in width and must not be torn or jagged along the cut line.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 36-39.

CONDITIONS FOR PERFORMANCE OF TASK

Job specifications
Measuring tape
Roofer's hatchet
Roofer's knife
"T" lock shingles

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall measurement of length using a measuring tape.
3. Choose and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 244-245.
2. Baker. **Carpentry Fundamentals**, pp. 199-201.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 244-245 and **Carpentry Fundamentals**, pp. 199-201.
2. Explain the purpose for cutting a starter course for the "T" lock shingle.
3. Have the students calculate the number of shingles needed to perform the task.
4. Prepare handout(s) showing starter course for the "T" lock shingle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 40

CRITERION-REFERENCED MEASURE

Questions

1. What is the minimum roof slope that may be used on this type shingle?
2. How far should the shingle be marked from the end?
3. After installing the "T" lock shingle you should check for __________ and ____________________.

Answers

1. 4" per foot
2. 9"
3. Tears and jagged edges

Practical Application

Have the students cut a starter course on "T" lock shingle; it should be nine inches in width and not be torn or jagged.

Method of Evaluating Practical Application

Use Checklist Performance Objective 40 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 40

CUTTING STARTER COURSE ON "T" LOCK SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Read job specifications.		
2. Measured edge of the roof where starter course was to be applied.		
3. Determined amount of "T" lock shingles required for the starter course.		
4. Counted out "T" lock shingles required for the starter course.		
5. Marked each shingle 9" from exposed end.		
6. Cut off each marked shingle along the marked line; repeated this process until all shingles were cut.		
7. Piled the starter course alongside remaining "T" lock. When starter course was applied remainder of the shingles were matched to starter course shingle for a double coverage of shingles, so that they matched in color and pattern.		
8. Checked for tears and jagged edges along cut line.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 40

CUTTING STARTER COURSE ON "T" LOCK SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Made adjustments or replaced by cutting new shingles.		
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 41

TASK

Cut wood ridges (top shingle butt first).

STANDARD OF PERFORMANCE OF TASK

Wood ridge shingles must not be jagged or splintered.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 122-124.
Reed. **Residential Carpentry**, pp. 375-376.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Job specifications
Measuring tape
Nails
Rotary rip saw
Safety glasses
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurement of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Miller. **Modern Carpentry**, pp. 248-254.
2. Baker. **Carpentry Fundamentals**, pp. 203-208.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry,** pp. 248-254 and **Carpentry Fundamentals**, pp. 203-208.
2. Determine the amount of wood shingles needed to cut for a ridge.
3. Discuss how to bundle shingles together to keep them from moving.
4. Demonstrate how to use the rotary rip saw safely.
5. Practice making cuts with the rotary rip saw.
6. Prepare handout(s) of wood ridge before and after material has been cut and installed.
7. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 41

CRITERION-REFERENCED MEASURE

Questions

1. Always pile the shingles in layers of __________ or __________.
2. What is the measurement from tip to butt of the shingle?
3. The proper size nail needed to install wood ridge is __________ or __________.

Answers

1. 6 or less
2. 5"
3. 5d or 6d

Practical Application

Have the students cut wood ridge so that they are not jagged or splintered.

Method of Evaluating Practical Application

Use Checklist Performance Objective 41 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 41

CUTTING WOOD RIDGES (TOP SHINGLE BUTT FIRST)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Measured the ridge to determine the amount of shingles to be cut.		
3. Prepared work area where shingles were piled and cut.		
4. Piled the shingles in layers of six or less, keeping butt the edge of each shingle flush.		
5. Nailed shingles together, keeping them from moving.		
6. Repeated this process until all shingles were bundled and nailed.		
7. Measured 5" from the butt and tip ends; marked top shingles by drawing a line across top shingle.		
8. Connected and positioned rip saw.		
9. Ripped along marked line. CAUTION: WHEN USING A ROTARY RIP SAW EXERCISE EXTREME CAUTION.		
10. Repeated ripping process until all shingles were cut.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 41

CUTTING WOOD RIDGES (TOP SHINGLE BUTT FIRST)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked shingle edges for jaggedness and splintering.		
12. Removed and replaced damaged shingles.		
13. Turned off and disconnected rip saw.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 42

TASK

Dub asphalt (fiberglass) shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be cut according to chalkline and must not be ripped or torn along the cut line.

SOURCE OF STANDARD

State of Georgia Writing Team
Johnson. **Roofer's Handbook**, p. 104.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Nails
Roofer's hatchet
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 236-237.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 236-237.
2. Explain purpose for dubbing asphalt shingles.
3. Explain how to identify shingles that are to be dubbed.
4. Have the students list tools needed to dub shingles.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 42

CRITERION-REFERENCED MEASURE

Questions

1. Shingles that __________ snapped line should be dubbed.
2. Always __________ or __________ any damaged shingles.
3. List tools needed to dub shingles.

Answers

1. Overlap
2. Repair, replace
3. Knife, hatchet, chalkline, and claw hammer.

Practical Application

Have the students dub asphalt shingles by snapping chalkline and cutting along line; shingles are not to be ripped or torn.

Method of Evaluating Practical Application

Use Checklist Performance Objective 42 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 42

DUBBING ASPHALT (FIBERGLASS) SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Inspected shingled work area.		
2. Installed and snapped lines along the edges of work area.		
3. Identified shingles which overlap snap line.		
4. Raised shingles to be dubbed by inserting hatchet underneath edge of shingle.		
5. Dubbed the shingle, cutting along the snap line. NOTE: Using a sharp knife and positive strokes will prevent tearing and ripping along the cut line.		
6. Repeated items 3, 4, and 5 until all shingles were dubbed.		
7. Checked dubbed shingles, repairing or replacing damaged shingles.		
8. Removed snap line.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 43

TASK

Dub wood shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must not be broken, must be cut along the chalkline, and must not be splintered and jagged.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 115.
Reed. **Residential Carpentry**, p. 373.

CONDITIONS FOR PERFORMANCE OF TASK

Backsaw
Claw hammer
Roofer's hatchet
Roofer's knife
Chalk line

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, p. 252.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, p. 252.
2. Explain the purpose of dubbing wood shingles.
3. Have the students list tools needed to dub wood shingles.
4. Prepare handout(s) showing wood shingles needing to be dubbed.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 43

CRITERION-REFERENCED MEASURE

Questions

1. To dub shingles a __________ or ________ may be used.
2. To prevent damaging deck when dubbing wood shingles use __________ __________ __________.
3. To cut the wood shingle it should be raised slightly by inserting a __________ or ____________________ underneath.

Answers

1. Hatchet or roofers knife
2. Slow, level strokes
3. Hatchet or another shingle

Practical Application

Have the students dub the wood shingle so that shingles are cut along chalkline and are not splintered or jagged.

Method of Evaluating Practical Application

Use Checklist Performance Objective 43 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 43

DUBBING WOOD SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inspected shingled work area.		
2. Identified shingles that must be dubbed.		
3. Marked a line along the shingles where excess would be dubbed.		
4. Raised the shingle slightly off deck by inserting hatchet or another shingle underneath.		
5. Used a backsaw to dub shingle. CAUTION: USE SLOW, LEVEL STROKES WHEN DUBBING TO PREVENT DAMAGE TO DECK. NOTE: Depending on the amount of dubbing, the hatchet or the roofer's knife may be used to dub.		
6. Checked shingles for damage.		
7. Repeated items 4, 5, and 6 until all shingles were dubbed.		
8. Repaired or replaced damaged shingles.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 44

TASK

Lay felt under ridge shingles.

STANDARD OF PERFORMANCE OF TASK

Felt must be bonded into bonding agent and there must be no rips, tears, or voids in the felt.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 125-128.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Bucket
Carpenter's saw
Claw hammer
Galvanized nails
Job specifications
Measuring tape
Upright broom
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurement of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Hutchings. **Carpentry and Building Construction**, pp. 539-540.

TEACHING ACTIVITIES

1. Read and discuss **Carpentry and Building Construction**, pp. 539-540.
2. Explain purpose of laying felt under ridge shingles.
3. Prepare handout(s) showing felt applied to ridge.
4. Practice cutting felt.
5. List tools necessary for laying felt to ridge.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 44

CRITERION-REFERENCED MEASURE

Questions

1. What is the width of the felt when cut for ridge?
2. Plywood strips are to be placed __________ within the ridge.
3. A second layer of felt should be applied. What is this width and what is the allowance for the overlap?

Answers

1. 12"
2. 6"
3. 8" and 2"

Practical Application

Have the students lay felt under ridge shingles so that it is bonded and has no rips, tears, or voids.

Method of Evaluating Practical Application

Use Checklist Performance Objective 44 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 44

LAYING FELT UNDER RIDGE SHINGLE

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured length of ridge.		
4. Measured, cut, and positioned roll of 12" felt. If more than one length was required, allowed for a two inch overlap.		
5. Applied bonding agent to the ridge area, making sure bonding agent was applied to over six inches on either side of the ridge.		
6. Centered the felt over ridge; felt was overlapped evenly on each side.		
7. Walked or broomed felt into the bonding agent and removed wrinkles.		
8. Cut plywood strips two inches wide and the length of the ridge; butted up strips if more than one strip was required.		
9. Nailed plywood strips on each side of ridge for the length of the ridge. Placement of strips was within 6" of the ridge.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 44

LAYING FELT UNDER RIDGE SHINGLE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Cut another strip of felt 8" wide to cover the length of the ridge, allowed for a 2" overlap at the seams if more than one strip was required.		
11. Applied bonding agent over ridge area to cover first layer of felt and wood strips.		
12. Checked for rips, tears, voids.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

17

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 45

TASK

Lay rigid asbestos (concrete) shingles.

STANDARD OF PERFORMANCE OF TASK

Shingle courses must be level, parallel to the ridge, have no damaged shingles, and rakes and eaves must be evenly trimmed.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, pp. 377-380.

CONDITIONS FOR PERFORMANCE OF TASK

Carpenter's saw
Chalk line
Chicken ladder
Claw hammer
Cold chisel
Folding ruler
Galvanized nails
Hip pad
Job specifications
Keyhole saw
Nail apron
Pry bar
Roofing hatchet
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 256-258.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 256-258.
2. Have the students review job specifications.
3. Prepare handout(s) showing correct pattern for laying rigid asbestos shingles.
4. Discuss safety rules as listed in **Modern Carpentry**, p. 257.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 45

CRITERION-REFERENCED MEASURE

Questions

1. Give another name for rigid asbestos shingles.
2. What is the minimum slope for the Dutch lap design?
3. Moisture trapped between shingles causes discoloration; this is called or is known as __________.

Answers

1. Mineral fiber
2. 5/12 slope
3. Blooming

Practical Application

Have the students lay rigid asbestos shingles level, parallel to ridge, and evenly trimmed at eaves.

Method of Evaluating Practical Application

Use Checklist Performance Objective 45 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 45

LAYING RIGID ASBESTOS (CONCRETE) SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Laid vertical and horizontal chalklines; squared up lines.		
4. Rolled back roofing felt at eaves; rolled back enough felt to fit the starter course.		
5. Laid chalk line for starter course and pattern lines for tie-ins.		
6. Loaded the roof, positioned shingles, and positioned chicken ladder.		
7. Laid starter shingles butt-up along the eave; allowed no more than 1/2" overhang to prevent shingles from breaking or cracking.		
8. Nailed shingles to the deck, placing nails in the holes provided in the shingles.		
9. Replaced felt over the starter shingles.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 45

LAYING RIGID ASBESTOS (CONCRETE) SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Laid first course of shingles at the rake edge, aligning the bottom edge with the starter shingles. Alternated half and whole shingles when starting at the rake. NOTE: When laying shingles allow no overlap or gap at shingle seams.		
11. Laid remaining shingles until work area was covered. NOTE: When laying successive rows of shingles allow sufficient exposure so nails just miss top edges of the bottom course.		
12. Checked shingles for damage and alignment.		
13. Made adjustments.		
14. Removed chicken ladder.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 46

TASK

Lay roll roofing.

STANDARD OF PERFORMANCE OF TASK

Roofing must be level and run parallel to ridge; edges must be sealed and waterproof; overlap must conform to the manufacturer's specifications.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 34-35.
Reed. **Residential Carpentry**, p. 361.
Roofers' Local #20. **Joint Apprenticeship Program**, p. 5.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Bonding agent applicator
Bucket
Chalk line
Claw hammer
Folding ruler
Galvanized nails
Nail apron
Pry bar
Push broom
Roofer's hatchet
Roofer's knife
Rubber boots
Job specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, p. 245.

TEACHING ACTIVITIES

1. Read and discuss **Modern Carpentry**, p. 245.
2. Have the students review job specifications and discuss.

PERFORMANCE OBJECTIVE 46

TEACHING ACTIVITIES (Continued)

3. Have the students estimate material and labor to complete job.
4. Prepare handout(s) showing proper installation of roll roofing.
5. Explain proper way to install bonding agent to roll roofing.
6. Explain proper nailing procedure to students.
7. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. A double coverage roll roofing is __________wide and the exposure is only _________wide.
2. The smooth surface called a selvage is ________wide.
3. The nailing procedure for the starter strip is __________from the upper edge.

Answers

1. 36" and 17"
2. 19"
3. 4 3/4"

Practical Application

Have the students lay roll roofing level and parallel to ridge. Edges must be sealed and waterproof. Overlap should conform to manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist Performance Objective 46 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 46

LAYING ROLL ROOFING

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Measured work area to determine amount of roofing required.		
4. Measured eave and gable overhang.		
5. Laid out chalk line so that vertical laps were at least 19".		
6. Loaded roof; positioned roll materials.		
7. Measured and cut roll roofing to length.		
8. Applied bonding agent to the deck at the rate of approximately 1 1/2 gallons per square, working from bottom to the top of the roof.		
9. Positioned roll roofing in bonding agent.		
10. Broomed and walked roofing down to eliminate wrinkles.		
11. Aligned and nailed roll roofing at the edges and trim.		
12. Repeated items 8 through 11, positioning subsequent layers of roll roofing and allowing for a 19" overlap.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 46

LAYING ROLL ROOFING

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Checked work area for contour, parallelism, and bonding.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 47

TASK

Lay square butt shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be secured and eave and rake edges must be evenly trimmed.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 27-32.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Galvanized fasteners
Job specifications
Measuring tape
Nail apron
Pry bar
Push broom
Putty knife
Roofer's hatchet
Roofer's knife
Roofing cement
Roof jacks

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 238-241.
2. Miller. **Carpentry Fundamentals**, pp. 187-188.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 238-241 and **Carpentry Fundamentals**, pp. 187-188.
2. Explain the layout of roofing materials.
3. Prepare handout(s) of roofing before and after installation.

PERFORMANCE OBJECTIVE 47

TEACHING ACTIVITIES (Continued)

4. Explain nailing procedure for each shingle.
5. Have the students build a mock roof section using one piece 4'X8' plywood.
6. Practice laying shingles on mock roof section.
7. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. What is the exposure of the three tab square butt shingle?
2. Give the measurement of the three tab square butt shingle.
3. How many nails are to be used for each shingle?

Answers

1. 5"
2. 12", 36"
3. 4

Practical Application

Have the students lay square butt shingles securely and trimmed evenly, at rake edge.

Method of Evaluating Practical Application

Use Checklist Performance Objective 47 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 47

LAYING SQUARE BUTT SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Layed out, positioned, and fastened starter shingles to deck, alternating half and whole shingles along the rake.		
4. Trimmed rake edge flush with rake.		
5. Positioned and lightly fastened second course of shingles, allowing shingles to overhang starter strip by at least 1". CAUTION: HAMMER THE NAILS IN VERTICALLY AND STOP WHEN THE NAIL HEAD IS FLUSH WITH THE SHINGLE. AVOID DIMPLING SHINGLE; CURLING MAY RESULT IF NAILS ARE DRIVEN TOO FAR IN.		
6. Made adjustment in aligning the first course; secured shingle by driving nails flush with shingle.		
7. Positioned and fastened first shingle in second course.		
8. Measured to insure proper alignment and exposure.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 47

LAYING SQUARE BUTT SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Repeated items 5 and 6 until second course was laid.		
10. Snapped horizontal and vertical layout lines. Horizontal lines insured proper exposure; the vertical lines were centered on the notches of the square butt shingles.		
11. Laid tie-ins for uneven eaves.		
12. Positioned and fastened shingles using layout lines until work area was completely covered. NOTE: In windy areas roofing cement may be dabbed under the overlap to prevent damage.		
13. Trimmed rakes and eaves of excessive overlaps.		
14. Checked work area to be certain that shingles were secured and trimmed at eaves and rakes.		
15. Made adjustments.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 48

TASK

Lay "T" lock tie-in pattern.

STANDARD OF PERFORMANCE OF TASK

"T" lock tie-in bonds must be perpendicular to horizontal runs, and rakes and eaves must be trimmed with a 3/4 inch overhang.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 36-39.
Reed. **Residential Carpentry**, pp. 364-365.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk lines
Claw hammer
Folding rule
Hip pad
Job specifications
Keyhole saw
Measuring tape
Metallic fasteners
Nail apron
Pry bar
Push broom
Roofing hatchet
Roof jacks
Roofer's knife
Staple gun
Staples

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Identify proper safety equipment.
4. Demonstrate safe work practices.

RESOURCE

Miller. **Carpentry Fundamentals**, pp. 200-201.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry Fundamentals**, pp. 200-201
2. Prepare handout(s) showing proper way to lay "T" lock pattern.

PERFORMANCE OBJECTIVE 48

TEACHING ACTIVITIES (Continued)

3. Explain proper way to back down shingles for correct pattern.
4. Have the students estimate the cost of labor and material to complete installation.
5. Construct a mock roof section of one piece 4'X8' plywood and practice installing "T" lock tie-in pattern.
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. The overhang at the rake should be __________.
2. Lockdown shingles are designed for ________ areas.
3. Lockdown shingles can be classified into __________ groups.

Answers

1. 3/4"
2. Windy
3. 5

Practical Application

Have the students lay "T" lock tie-in pattern perpendicular to horizontal run with eaves trimmed. Overhang should be 3/4".

Method of Evaluating Practical Application

Use Checklist Performance Objective 48 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 48

LAYING "T" LOCK TIE-IN PATTERN

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined laydown pattern.		
4. Loaded roof with "T" lock shingles.		
5. Snapped a chalk line at rake allowing for a 3/4" overhang.		
6. Positioned initial row of "T" lock shingles along rake using chalkline for proper spacing and positioning.		
7. Fastened "T" locks to the deck. NOTE: This row of shingles must be laid straight to lay out an even tie-in measure to insure even tie-ins.		
8. Snapped vertical and horizontal chalklines even with shingles installed. NOTE: Since eaves may be uneven, use the first row of shingles as a guide to the horizontal line. To check accuracy, measure down from ridge and make adjustments in chalk line.		
9. Determined where starter course began by backing down shingles. NOTE: When backing down using "T" locks be sure you do not accidentally move one of the shingles during the backdown process. This would cause a missed tie-in.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 48

LAYING "T" LOCK TIE-IN PATTERN

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Placed starter course shingles and fastened.		
11. Placed second "T" lock on initial starter course shingle and carefully slid second shingle into the notch of the first shingle to tie-in and fastened to deck.		
12. Continued process of laying the starter course until work area was covered to the eaves and ridges.		
13. Shingled back-up making sure tie-ins were locked evenly before fastening. NOTE: Tie-in with "T" locks is a very reliable method of shingling. There should not be too many adjustments if the roofer works slowly and carefully.		
14. After the second course was laid, checked tie-ins for straightness and evenness; made adjustments.		
15. Trimmed rake and eaves so that there was a 3/4" overhang.		
16. Checked work area for evenness, perpendicularity, and overhang.		
17. Made adjustments.		
18. Cleaned the work area.		
19. Cleaned tools and equipment.		
20. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 49

TASK

Lay terra cotta shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be butted square, joints waterproofed, and the vertical and horizontal lines must be within 1" of perpendicularity; shingles must not be damaged.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, p. 380.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk lines
Claw hammer
Folding rule
Hip pad
Job specifications
Keyhole saw
Measuring tape
Mop
Nail apron
Pry bar
Push broom
Putty knife
Roof jacks
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Teacher Information Sheet.
2. Wagner. **Modern Carpentry**, pp. 259-260.

TEACHING ACTIVITIES

1. Have the students read and discuss **Teacher Information Sheet** and **Modern Carpentry**, pp. 259-260.
2. Explain that terra cotta shingles are brittle and can be easily broken.

PERFORMANCE OBJECTIVE 49

TEACHING ACTIVITIES (Continued)

3. Prepare handout(s) giving information sheet on materials used in manufacturing of terra cotta shingles.
4. Prepare a list of tools needed to lay terra cotta shingles.
5. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. What material is used in the manufacturing of terra cotta shingles?
2. Give a brief description of what is needed to lay terra cotta shingles over an old roof.
3. What is used to fasten starter shingles to second course of terra cotta shingles?

Answers

1. Baked earth or fired clay.
2. Roof framing must be strong enough to stand additional weight.
3. Clips

Practical Application

Have the students lay terra cotta shingles so that joints are waterproof and butted square. All vertical and horizontal lines must be within 1" of perpendicular. Damaged shingles must not be used.

Method of Evaluating Practical Application

Use Checklist Performance Objective 49 to determine if the assignment was completed.

CHECKLIST FOR PERFORMANCE OBJECTIVE 49

LAYING TERRA COTTA SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined layout pattern.		
4. Loaded the roof with roofing materials. CAUTION: TERRA COTTA SHINGLES ARE BRITTLE AND CAN EASILY BE BROKEN. EXERCISE EXTREME CAUTION WHEN LIFTING AND PUTTING DOWN SHINGLES. DO NOT WALK ON SHINGLES.		
5. Snapped vertical and horizontal bond lines.		
6. Positioned and attached nailing strips along chalk lines.		
7. Positioned, aligned, and fastened starter shingles.		
8. Placed second course, attached clips to fasten first course to second, and bent clip into place to secure; worked from the ridge along rake to eave.		
9. Continued process until work area was covered.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 49

LAYING TERRA COTTA SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Trimmed rakes and eaves.		
11. Applied roofing cement to shingle joints.		
12. Checked for alignment and cracked or damaged shingles.		
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

TEACHER INFORMATION SHEET

(PERFORMANCE OBJECTIVE 49)

Terra cotta tile shingles first became important in architecture in the 7th Century B.C. by the Greeks who used it for roof tiles. Terra Cotta lost its importance and was ignored by architects at the end of the 5th Century A.D. until the Renaissance when it was most highly esteemed as an artistic medium. It lost its importance again in the 16th Century but was again used by modern architects for its lightness and durability. For resource purposes, **Modern Carpentry**, pp. 259-260, Title: Tile Roofing, gives information useful in laying terra cotta shingles.

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 50

TASK

Lay tile shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must have no gap between; overhang must not be more than 3/4" at eave and rake; shingles must not be damaged.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, pp. 379-380.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Folding rule
Galvanized roofing nails, 1 1/4"
Hip pad
Job specifications
Measuring tape
Nail apron
Pry bar
Push broom
Roofer's knife
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 259-260.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 259-260.
2. Prepare handout(s) of various steps for laying tile shingles.
3. Explain the two methods of application of tile shingles.
4. Explain nail procedure for laying tile shingles.
5. Explain safety precautions for laying tile shingles.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 50

CRITERION-REFERENCED MEASURE

Questions

1. Name the two methods of application for tile shingles.
2. List at least two materials used in manufacturing tile shingles.
3. Tile shingles should not overlap at eave or rake more than ________ because they are prone to break.

Answers

1. Mission and Spanish
2. Hardburn shale or shale and clay
3. 3/4"

Practical Application

Have the students lay tile shingles with no gaps and overhang of no more than 3/4" at eave and rake.

Method of Evaluating Practical Application

Use Checklist Performance Objective 50 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 50

LAYING TILE SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined layout pattern for shingles.		
4. Loaded roof with shingles. CAUTION: TILE SHINGLES ARE BRITTLE AND CAN BE BROKEN EASILY. EXERCISE CAUTION WHEN LIFTING AND PLACING SHINGLES. DO NOT WALK ON SHINGLES.		
5. Snapped vertical and horizontal lines to conform to layout pattern.		
6. Laid a row of starter shingles along eave; lined shingles up with horizontal chalk lines. NOTE: Tile shingles have pre-drilled holes for nails; hammer nails flush, but do not hit shingles with the hammer.		
7. Started first course of shingles over starter row; bottom and side edges were aligned with starter row.		
8. Continued process until first row of shingles reached the opposite rake. NOTE: Do not let tile shingles overlap eave or rake by more than 3/4"; they are prone to break if longer.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 50

LAYING TILE SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Began the second course of shingles with a half shingle; alternated a whole and half shingle along rake to ridge. Made sure the nails missed the top edge of the shingle below. NOTE: A tile shingle may be cut by scoring with a scribe and snapping shingle along line.		
10. Continued the process of placing and fastening shingles until work area was covered.		
11. Checked work area for damaged shingles, gaps, and overhang.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 51

TASK

Lay wood shakes.

STANDARD OF PERFORMANCE OF TASK

Shakes must be laid with alternating joints; rakes and eaves must be trimmed; horizontal runs must be parallel to the ridge; shingles must not be damaged.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 125-133.
Reed. **Residential Carpentry**, pp. 371-377.

CONDITIONS FOR PERFORMANCE OF TASK

- Builder's saw
- Chalk line
- Claw hammer
- Folding rule
- Galvanized fasteners
- Hip pad
- Job specifications
- Keyhole saw
- Measuring tape
- Nail apron
- Pry bar
- Roof jacks
- Roofer's knife
- Roofing felt
- Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 253-255.

TEACHING ACTIVITIES

1. Have the student read and discuss **Modern Carpentry**, pp. 253-255.
2. Discuss three basic types of wood shake.

PERFORMANCE OBJECTIVE 51

TEACHING ACTIVITIES (Continued)

3. Explain spacing allowed for expansion in laying wood shake.
4. Prepare handout(s) showing correct procedure for laying wood shake starter course.
5. Explain maximum exposure for wood shake.
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. What is the spacing allowed for expansion between wood shakes?
2. What is the maximum exposure for wood shake shingles?
3. What is the size and type nail recommended for applying wood shake shingles?

Answers

1. 1/4 to 3/8".
2. 13" for 32" shakes, 10" for 24" and 8 1/2" for 18" shakes.
3. 6 d nail rust-resistant (hot dipped, zinc-coated type)

Practical Application

Have the students lay wood shake alternating joints, rake and eaves trimmed, and horizontal runs to be parallel to ridge.

Method of Evaluating Practical Application

Use Checklist Performance Objective 51 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 51

LAYING WOOD SHAKES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined laydown pattern for shingles.		
4. Snapped vertical and horizontal lines to conform to laydown pattern.		
5. Loaded roof with roofing materials.		
6. Positioned and fastened a strip of beveled siding on edge of the rake.		
7. Positioned and secured starter shakes at rake, allowed for a 1" to 1 1/2" overlap at rake and eaves. CAUTION: WHEN FASTENING SHAKE, DRIVE NAILS SO THEY ARE FLUSH WITH THE SHINGLE: DO NOT DIMPLE.		
8. Laid roofing felt under first course and each succeeding course of shakes.		
9. Laid the first course starting from rake, running along eave until reaching opposite rake.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 51

LAYING WOOD SHAKES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Laid succeeding courses alternating joints; maintained even exposure by trimming and keeping courses parallel to ridge. NOTE: To maintain even exposure use a board or the roofing hatchet as a reference.		
11. Layed roofing felt over top layer of each course.		
12. Completed laying straight courses up to ridge.		
13. Checked work area for parallelism, damaged shingles, exposure, and even trimming.		
14. Made adjustments.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature ____________________ Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 52

TASK

Lay wood shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be laid with alternating joints; rakes and eaves must be trimmed; horizontal runs must be parallel to ridge; shingles must not be damaged.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 125-133.
Reed. **Residential Carpentry**, pp. 371-377.

CONDITIONS FOR PERFORMANCE OF TASK

Builder's saw
Chalk line
Claw hammer
Folding rule
Galvanized fasteners
Hip pad
Job specifications
Keyhole saw
Measuring tape
Nail apron
Pry bar
Roof jacks
Roofer's knife
Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, p. 248.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, p. 248.
2. Discuss exposure and how roof pitch dictates amount of wood shingles to be exposed.

PERFORMANCE OBJECTIVE 52

TEACHING ACTIVITIES (Continued)

3. Explain how wood shingles are bundled and how many it takes to cover 100 square feet.
4. Have the students, with measurements given, figure the amount of shingles needed to complete the task.
5. Discuss types and grades of wood shingles.
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Exposure of 5" to 7 1/2" is allowed for wood shingles if the pitch is ________ or greater.
2. To what lengths are wood shingles manufactured?
3. What is a major disadvantage of using wood shingles?

Answers

1. 5/12
2. 16", 18", and 24"
3. They have little resistance to fire.

Practical Application

Have the students lay wood shingles with alternating joints, horizontal runs parallel to ridge, and eaves and rakes trimmed.

Method of Evaluating Practical Application

Use Checklist Performance Objective 52 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 52

LAYING WOOD SHINGLES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Determined laydown pattern for shingles.		
4. Snapped vertical and horizontal lines to conform to laydown pattern.		
5. Loaded the roof with roofing materials.		
6. Positioned and fastened a strip of beveled siding on the edge of rake.		
7. Positioned and secured the starter course of wood shingles at rake and eaves; allowed for a 1" - 1 1/2" overlap at the rake. CAUTION: WHEN FASTENING WOOD SHINGLES DRIVE NAILS SO THEY ARE FLUSH WITH THE SHINGLE: DO NOT DIMPLE.		
8. Laid first course of shingles starting from the rake along the eave to the opposite rake.		
9. Laid succeeding courses alternating the joints; maintained even exposure by trimming and keeping courses parallel to ridge. NOTE: To maintain even exposure use a board or the roofing hatchet as a reference.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 52

LAYING WOOD SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Repeated item 9 until the straight courses reached ridge.		
11. Checked work area for parallelism, damaged shingles, exposure, and even trimming.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 53

TASK

Shingle a closed valley.

STANDARD OF PERFORMANCE OF TASK

Shingles must be fastened in an alternating pattern, must not be damaged, and must be trimmed flush with ridge.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 65-76.
Reed. **Residential Carpentry**, p. 370.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Folding rule
Galvanized fasteners
Hand saw
Hip pad
Job specifications
Measuring tape
Nail apron
Pry bar
Roof jacks
Roofer's knife
Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCES

1. Wagner. **Modern Carpentry**, pp. 236-237.
2. Baker. **Fundamentals of Carpentry**, pp. 182-183.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 236-237, and **Fundamentals of Carpentry**, pp. 182-183.
2. Explain the differences between a closed valley and a woven valley.
3. Discuss the nailing procedure for shingling a closed valley.

TEACHING ACTIVITIES (Continued)

4. Prepare handout(s) showing a valley before and after shingles have been installed.
5. Explain how to apply plastic asphalt cement before installing closed valley shingles.
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. To shingle a closed valley, shingles are installed in (a) an __________ pattern.
2. A strip of plastic asphalt cement __________ is applied to the valley to embed the shingle.
3. You should nail shingles at least ________inches away from center of valley.

Answers

1. Alternating
2. 3" wide
3. 6"

Practical Application

Have the students shingle a closed valley in an alternating pattern and trimmed flush with the ridge.

Method of Evaluating Practical Application

Use Checklist Performance Objective 53 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 53

SHINGLING A CLOSED VALLEY

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Extended strip shingles at least one foot past center of the valley.		
4. Positioned shingles so they overlapped in the alternating pattern; first, laid shingle from one side of the adjoining roof, then from the other.		
5. Applied pressure to the extended strip so it conformed to the shape of the valley; nailed the end of the strip to secure shingle. CAUTION: TO PREVENT LEAKS DO NOT DRIVE NAILS IN THE CENTER OF A VALLEY.		
6. Repeated items 3 through 5 until valley was shingled.		
7. Trimmed the shingles at ridge.		
8. Checked work area for damage; trimmed and alternated pattern.		
9. Made adjustments.		
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 54

TASK

Shingle a hip.

STANDARD OF PERFORMANCE OF TASK

Hip shingles must be fastened and form a line parallel to peak of hip.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, p. 368.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Folding rule
Galvanized fasteners
Hand saw
Hip pad
Job specifications
Measuring tape
Pry bar
Putty knife
Roof jacks
Roofer's knife
Roofing cement
Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Baker. **Fundamentals of Carpentry**, pp. 188, 198, 100, 203.

TEACHING ACTIVITIES

1. Have the students read and discuss **Fundamentals of Carpentry**, pp. 188, 198, 200, 203.
2. Explain nailing pattern for shingling a hip.
3. Discuss how to trim main run shingles to match hip angle.

TEACHING ACTIVITIES (Continued)

4. Explain how to measure and cut rolled roofing strip to be applied to hip.
5. Demonstrate how to snap chalkline for purpose of aligning hip shingles.
6. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. What is the nailing pattern for the hip shingle?
2. Cut roll roofing __________ wide and overlap _______ on each side of hip.
3. What is the exposure of the hip shingle?

Answers

1. 5 1/2" from lower end and 1" up from end.
2. 12" wide and 6" on each side
3. 5"

Practical Application

Have the students shingle a hip. They must form a line parallel to peak of hip.

Method of Evaluating Practical Application

Use Checklist Performance Objective 54 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 54

SHINGLING A HIP

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Trimmed main run shingles to match hip angle.		
4. Measured and cut a strip of roll roofing 12" wide; positioned and secured on the hip with a 6" overlap on each side. NOTE: If more than one strip is required to cover the hip, allow 3" overlap at seams.		
5. Snapped chalk line outside the lines of the hip shingles to assist in alignment.		
6. Positioned and secured the starter shingle at eave and fastened.		
7. Positioned and fastened subsequent shingles on chalkline; overlapped each shingle at least 5" and secured.		
8. Nailing pattern was 5 1/2" from lower end and 1" up from edge.		
9. Matched hip to hip by overlapping shingles.		
10. Applied roofing cement around all edges of top shingle.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 54

SHINGLING A HIP

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked work area for fastened shingles and the line parallel to peak of hip.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 55

TASK

Shingle a hip (asbestos, concrete).

STANDARD OF PERFORMANCE OF TASK

Shingles must be pointed with roofing cement, waterproof, and parallel to hip of the roof.

SOURCE OF STANDARD

Reed. **Residential Carpentry,** p. 379.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Folding rule
Galvanized fasteners
Hip pad
Job specifications
Pry bar
Putty knife
Roof jacks
Roofer's knife
Roofing hatchet
Rotary saw
Safety glasses
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry,** p. 259, also p. 256 for safety.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry,** p. 259, also p. 256 for safety.
2. Explain correct exposure for shingling a hip (asbestos).
3. Discuss safety precautions for working with asbestos hip shingles.
4. Demonstrate how to cut and install wood strips for nailing hip shingles.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 55

CRITERION-REFERENCED MEASURE

Questions

1. How wide should furring strips be for each side of ridge?
2. Name four types of protective clothing needed when installing hip shingles (asbestos).
3. What type of tool is used to cut hip shingles (asbestos).

Answers

1. 2"
2. Respirator, gloves, hat, and safety glasses.
3. Carbide tip knife blade

Practical Application

Have the students shingle a hip using asbestos or concrete shingles, parallel to hip of roof; point with roof cement.

Method of Evaluating Practical Application

Use Checklist Performance Objective 55 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 55

SHINGLING A HIP (ASBESTOS, CONCRETE)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Inspected and prepared the work area.		
3. Measured and cut a layer of 12" felt to cover hip. NOTE: If more than one strip is necessary, allow for a 3" overlap at seams.		
4. Positioned and fastened felt on hip; felt overlapped the hip by 6" on each side.		
5. Snapped chalk lines 5"-8" below the hip and parallel to hip.		
6. Cut two strips of wood approximately 2" wide. Positioned and secured these wood strips on the chalkline to serve as guide boards. NOTE: When laying the guide boards, match pre-drilled holes in the shingle with guide board so fastening is possible.		
7. Positioned, trimmed, and fastened shingle on guide board starting at rake. CAUTION: ASBESTOS OR CONCRETE SHINGLES ARE BRITTLE AND CAN BE BROKEN EASILY. EXERCISE CAUTION WHEN LIFTING AND PLACING SHINGLES. NOTE: Asbestos and concrete shingles have pre-drilled holes for nails; drive nails flush to shingle and avoid striking shingle with hammer.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 55

SHINGLING A HIP (ASBESTOS, CONCRETE)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Positioned, trimmed and fastened shingles so that alternate overlaps of joints occurred on ridge. NOTE: Asphalt or concrete shingles may be trimmed by scoring with a scriber and snapping shingle along line.		
9. Repeated item 8 until the hip was shingled.		
10. Applied roofing cement between the shingles and covered all nail heads.		
11. Checked work area for a parallel line and made sure all joints and nailheads were painted.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 56

TASK

Shingle a ridge.

STANDARD OF PERFORMANCE OF TASK

Shingles must be fastened, squarely positioned, trimmed, and parallel to peak of ridge.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 77-82.
Reed. **Residential Carpentry**, p. 368.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Foldout rule
Galvanized fasteners
Hip pad
Job specifications
Pry bar
Putty knife
Roof jacks
Roofer's knife
Roofing cement
Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall the measurements of length using a carpenter's rule.
3. Select and use basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 242-243, 252.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 242-243, 252.
2. Demonstrate how to cut shingles for installation of ridge shingle.
3. Discuss the amount of exposure required for each ridge shingle.
4. Prepare handout(s) showing nailing procedure for ridge shingles.
5. Explain how to use chalkline to run ridge shingle straight and parallel to eave.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 56

CRITERION-REFERENCED MEASURE

Questions

1. What is the exposure of the ridge shingle?
2. What is the nailing procedure for the ridge shingle?
3. Give a brief description of the procedure for preparing ridge shingles for installation in cold weather.

Answers

1. 5"
2. 5 1/2" back from exposed end and 1" from edge
3. Shingles should be warmed to prevent cracking or breaking.

Practical Application

Have the students shingle a ridge. Shingles must be squarely positioned and parallel to the peak of ridge.

Method of Evaluating Practical Application

Use Checklist Performance Objective 56 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 56

SHINGLING A RIDGE

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Topped out strip shingles to the ridge.		
4. Cut strip shingles into 12" sections and nailed over ridge.		
5. Positioned and fastened starter course of precut shingles, starting from either rake.		
6. Trimmed ridge tab from the shingles.		
7. Positioned and fastened remaining shingles using roofing cement and nails; allowed for a 5" lap. NOTE: Make laps with the prevailing wind and cement thoroughly.		
8. Applied roofing cement to exposed nail heads.		
9. Checked work area for shingle positioning, trimming, and parallelism.		
10. Made adjustments.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

CHECKLIST FOR PERFORMANCE OBJECTIVE 60

SHINGLING A BOSTON RIDGE (WOOD SHAKE)

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared hip area.		
3. Trimmed main roof shingles at the hip; added another nail approximately 1" from the lower end of the hip.		
4. Snapped a chalk line parallel to the hip to position guide boards.		
5. Positioned and fastened two guide boards one shingle length away from hip; used snap line as a guide.		
6. Used shingles at least 6" wide to position starter shingle against the guide board so that the other end overlapped hip.		
7. Beveled the edges of shingle.		
8. Used the same procedure, as items 6 and 7, nailed shingle on opposite side, trimmed overlap; but, beveled in the opposite manner. NOTE: A miter box may be used to accomplish bevel.		

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 57

TASK

Shingle a ridge (wood shakes).

STANDARD OF PERFORMANCE OF TASK

Shingles must be overlapped in an alternating pattern and be securely fastened.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 122-124.
Reed. **Residential Carpentry**, pp. 375-376.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Foldout rule
Galvanized fasteners
Hand saw
Hip pad
Job specifications
Keyhole saw
Measuring tape
Pry bar
Putty knife
Roofer's knife
Roofing cement
Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify overlapping patterns.
3. Choose basic tools needed.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 251-255.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 251-255.
2. Discuss the purpose of covering a ridge.
3. Explain the types of materials needed.
4. Illustrate the completed ridge.
5. Discuss estimating procedures.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 57

CRITERION-REFERENCED MEASURE

Questions

1. In the best grade of wood shingles, the annual rings run __________ to the surface.
2. Good tight ridges and hips are required to avoid roof __________.
3. The hip and ridge units can be purchased __________.

Answers

1. Perpendicular
2. Leakage
3. Prefabricated

Practical Application

Have the students shingle a ridge with wooden shakes so that the shingles will appear neatly constructed. They must be overlapped in an alternating pattern and be securely fastened.

Method of Evaluating Practical Application

Use Checklist Performance Objective 57 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 57

SHINGLING A RIDGE (WOOD SHAKES)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Ran out top course of shingles to ridge.		
4. Measured length of ridge.		
5. Measured and cut a 2" nailing strip to fit length of the ridge; butted the ends if more than one length was required.		
6. Snapped a line parallel to ridges.		
7. Positioned and nailed the strips of wood parallel to ridge, approximately 3" from peak, following chalk line.		
8. Positioned and fastened undercourse starter shingles at rake.		
9. Beveled the ends of shingles to be lapped.		
10. Positioned and fastened the shingles at the peak of the ridge; beveled ends joined in a staggered pattern.		
11. Trimmed shingles.		
12. Positioned and fastened saddle shingles.		
13. Used roofing cement to seal joints and paint nails.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 57

SHINGLING A RIDGE (WOOD SHAKES)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
14. Checked work area for overlapping and alternating patterns.		
15. Made adjustments.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature   Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 58

TASK

Shingle a ridge with a ridge roll.

STANDARD OF PERFORMANCE OF TASK

Shingles must be securely fastened, ends pointed, and roll must be parallel to top of ridge.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 34-35.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Foldout rule
Galvanized fasteners
Hand saw
Hip pad
Job specifications
Keyhole saw
Nail apron
Putty knife
Roof cement
Roof jacks
Roofer's knife
Roofing hatchet
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret manufacturer's specifications.
2. Choose and use basic tools.
3. Identify overlapping patterns.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 242-260.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 242-260.
2. Illustrate the completed ridge.
3. Discuss the purpose of a ridge roll.

PERFORMANCE OBJECTIVE 58

TEACHING ACTIVITIES (Continued)

4. Demonstrate the process for estimating materials for ridge roll construction.
5. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Mineral fiber roofing products are made from asbestos and __________ __________.
2. Exposed fasteners should be covered with __________ __________.
3. Three-Tab square butt shingles are __________ inches long.

Answers

1. Portland cement
2. Waterproof cement
3. 36 inches

Practical Application

Have the students shingle a ridge with a ridge roll so that the ridge does not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 58 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 58

SHINGLING A RIDGE WITH A RIDGE ROLL

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared ridge area.		
3. Ran-out top course of shingles to ridge.		
4. Measured and cut a wood strip to fit length of ridge, height of strip in accordance with manufacturer's specifications. NOTE: If more than one strip is required, butt ends.		
5. Positioned and nailed wood strip upright on top of ridge board.		
6. Measured and cut a piece of roofing felt wide enough to overlap top course of shingles on each side of ridge, and long enough to cover length of the ridge. NOTE: If more than one length of felt is required, allow for a 3" overlap at seams.		
7. Positioned and fastened starter piece of ridge roll on one side of the ridge, allowing felt to overhang the rake by at least 1".		
8. Positioned and nailed the roll to upright strip, set nails approximately 3" apart.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 58

SHINGLING A RIDGE WITH A RIDGE ROLL

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Positioned last half of ridge roll and nailed to other side of the ridge; insured roll overlapped top course of shingles by 2".		
10. Applied waterproof cement to all exposed fasteners.		
11. Pointed up end holes.		
12. Checked work area for pointing and parallelism.		
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 59

TASK

Shingle an open valley.

STANDARD OF PERFORMANCE OF TASK

Shingles must be trimmed, aligned, fastened securely, and sealed with roofing cement.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 65-76.
Reed. **Residential Carpentry**, p. 369.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Foldout rule
Galvanized fasteners
Hand saw
Hip pad
Job specifications
Nail apron
Putty knife
Roof jacks
Roofer's knife
Roofing cement
Roofing hatchet

ENABLING OBJECTIVES

1. Identify flashing process.
2. Read and interpret job specifications.
3. Recall materials needed for open valley.
4. Demonstrate safe work practices.

RESOURCE

Feirer, et al. **Carpentry and Building Construction**, pp. 519-524.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction**, pp. 519-524.
2. Explain the purpose for shingling an open valley.
3. Draw a diagram of an open valley.
4. Discuss types of materials needed to flash a valley.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 59

CRITERION-REFERENCED MEASURE

Questions

1. Open valleys may be flashed with __________ or with 90 lb. building felt.
2. Shingles should be cut __________ from the center line of the valley.
3. Building felt used in a valley should be a __________ lb. felt.

Answers

1. Metal
2. 3 in.
3. 90 lb.

Practical Application

Have the students shingle an open valley so that the valley appears neatly constructed and does not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 59 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 59

SHINGLING AN OPEN VALLEY

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared valley.		
3. Snapped a line down valley using flashing as a guide.		
4. Positioned and aligned first course of shingles with chalk line.		
5. Marked and trimmed shingles to fit.		
6. Applied roofing cement to underside of trimmed shingles along trimmed edges.		
7. Nailed down shingles, made sure shingles were pressed into bonding.		
8. Repeated items 4 through 7 until valley was shingled.		
9. Checked work area for trim, security, and alignment.		
10. Made adjustments.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 60

TASK

Shingle a Boston Ridge (wood shake).

STANDARD OF PERFORMANCE OF TASK

Shingles or shakes must be trimmed and fastened securely.

SOURCE OF STANDARD

Reed. **Residential Carpentry**, p. 375.

CONDITIONS FOR PERFORMANCE OF TASK

- Chalk line
- Claw hammer
- Foldout rule
- Galvanized fasteners
- Hand saw
- Job specifications
- Keyhole saw
- Pry bar
- Putty knife
- Roof cement
- Roofer's knife
- Roofing hatchet

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Choose and use basic tools.
3. Identify alternate lapping pattern.
4. Demonstrate safe work practices.

RESOURCE

Feirer. **Carpentry and Building Construction**, pp. 539-546.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction,** pp. 539-546.
2. Illustrate completed ridge.
3. Explain lapping pattern.
4. Compare the Boston Ridge Process with a hip ridge.
5. Plan a field trip to a local site that has shingling and wooden shakes.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 60

CRITERION-REFERENCED MEASURE

Questions

1. Nails for a Boston Ridge should be __________ sizes larger than those required for the shingles.
2. Boston Ridge is installing in a(n) __________ pattern.
3. Boston Ridge requires the use of __________ nails.

Answers

1. Two
2. Alternate
3. Blind

Practical Application

Have the students shingle a Boston Ridge with wooden shakes so that it appears neatly constructed and does not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 60 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 60

SHINGLING A BOSTON RIDGE (WOOD SHAKE)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Continued application of shingles until hip was shingled.		
10. Pointed up nails.		
11. Checked work area for trim and security.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 61

TASK

Shingle around a pipe.

STANDARD OF PERFORMANCE OF TASK

Shingles must be trimmed flush with the pipe and water must not leak around the edges of the pipe.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 87-89.
Reed. **Residential Carpentry**, p. 370.
U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 14.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 175.

CONDITIONS FOR PERFORMANCE OF TASK

Bucket
Claw hammer
Foldout rule
Galvanized fasteners
Job specifications
Putty knife
Roof jacks
Roofer's knife
Roofing cement
Roofing hatchet
Scriber

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select basic tools needed.
3. Identify pipe sizes.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 241-243.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 241-243.
2. Explain the process for cutting hole in a shingle.
3. Demonstrate how to determine the type of pipe as well as size.

PERFORMANCE OBJECTIVE 61

TEACHING ACTIVITIES (Continued)

4. Illustrate the purpose of a boot.
5. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. Pipes projected through the roof must be carefully __________.
2. Two types of boots for pipes are leaded and __________.
3. ____________________ should be applied around boot flange and pipe.

Answers

1. Flashed
2. Vinyl
3. Roofing cement

Practical Application

Have the students shingle around a pipe so that it does not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 61 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 61

SHINGLING AROUND A PIPE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared area around pipe.		
3. Continued to lay strip shingles to the pipe.		
4. Prepositioned a shingle over the pipe and outlined pipe location on shingle.		
5. Cut out outline using care not to rip or tear shingle.		
6. Positioned shingle over pipe and slid shingle down to roof. NOTE: Pipe cut-out may be ragged and not allow the pipe to fit. Do not force, but trim the hole to fit.		
7. Fastened shingle in normal manner.		
8. Positioned and fastened the boot flange on pipe.		
9. Continued laying shingles in normal manner; trimmed around pipe.		
10. Applied roofing cement around boot flange and pipe.		
11. Checked work area for trim, flush, and voids.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 61

SHINGLING AROUND A PIPE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Tested for leaks by applying some water.		
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 62

TASK

Shingle a woven hip (wood shakes).

STANDARD OF PERFORMANCE OF TASK

Shingles must be fastened and trimmed with no splinters or cracks.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, p. 124.
Reed. **Residential Carpentry**, p. 374.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Foldout rule
Galvanized fasteners
Hand saw
Job specifications
Keyhole saw
Putty knife
Roof jacks
Roofer's knife
Roofing cement
Roofing hatchet
Scriber
Steel square

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify woven pattern.
3. Recall use of basic tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 250-256.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 250-256.
2. Review layout procedures for wooden shakes.
3. Explain the purpose of shingling a woven hip roof.
4. Plan a field trip at a local site.
5. Illustrate the completed woven hip.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 62

CRITERION-REFERENCED MEASURE

Questions

1. In the best grade of wood shingle, the annual rings run __________ to the surface.
2. The vertical joint between wood shingles in adjacent courses should be spaced at least __________ inches apart.
3. Wooden shakes are highly __________.

Answers

1. Perpendicular
2. 1 1/2 inches
3. Durable

Practical Application

Have the students shingle a woven hip that is fastened properly with no splinters or cracks.

Method of Evaluating Practical Application

Use Checklist Performance Objective 62 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 62

SHINGLING A WOVEN HIP (WOOD SHAKES)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Read job specifications.		
2. Inspected and prepared hip area.		
3. Selected wooden shingles or shakes approximately 6" wide.		
4. Laid out 5 wood shingles/shakes, butt ends aligned, one side flush.		
5. Measured 5" from the flush edge of the shingles/shakes; scribed a line.		
6. Cut shingles from butt to tip along the scribed line; special cut shingles/shakes should fit flush against the edges of the main course shingles/shakes running into the hip.		
7. Positioned pre-cut shingles/shakes against the tip of the main course shingles and nailed into place. NOTE: When nailing wood shingles/shakes drive nail until nail head is flush with shingle; do not dimple.		
8. Continued laying first course.		
9. Pre-cut second course of shingles/shakes to fit run of common rafter.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 62

SHINGLING A WOVEN HIP (WOOD SHAKES)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Positioned and fastened second course of shingles/shakes allowing the edge of shingles/shakes to overlap hip.		
11. Positioned and fastened the regular courses of shingles/shakes along both sides of hip.		
12. Positioned and fastened shingles to the top of hip, alternating lap of hip shingles.		
13. Trimmed hip shingles for proper fit, alignment and exposure.		
14. Pointed up exposed nail fasteners with roofing cement.		
15. Checked work area for security, trim, cracks and splinters.		
16. Made adjustments.		
17. Cleaned work area.		
18. Cleaned tools and equipment.		
19. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY INSTALLING SHINGLES

PERFORMANCE OBJECTIVE 63

TASK

Strip lay asphalt/fiberglass shingles.

STANDARD OF PERFORMANCE OF TASK

Shingles must be fastened to deck, have specified exposure, and must not be torn or damaged.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 19-39.
Reed. **Residential Carpentry**, pp. 364-370.

CONDITIONS FOR PERFORMANCE OF TASK

Chalk line
Claw hammer
Folding rule
Galvanized fasteners
Hip pad
Job specifications
Measuring tape
Nail apron
Roof jacks
Roofer's knife
Roofing hatchet
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify layout patterns.
3. Choose proper hand tools.
4. Demonstrate safe work practices.

RESOURCE

Feirer. **Carpentry and Building Construction**, pp. 528-534.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction**, pp. 528-534.
2. Explain roof layout procedures.
3. Discuss types of strip shingles.
4. Instruct the students how to estimate the number of shingles needed for a given job.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 63

CRITERION-REFERENCED MEASURE

Questions

1. On small roofs strip shingles may be laid from either __________.
2. The first course of shingles is called the ____________________.
3. Each strip of shingle will need ________ to ________ nails.

Answers

1. Rake
2. Starter course
3. 4, 6

Practical Application

Have the students strip lay asphalt/fiberglass shingles, so that the bond appears neatly in line and does not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 63 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 63

STRIP LAYING ASPHALT/FIBERGLASS SHINGLES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications for the shingles being used.		
3. Inspected and prepared roof deck.		
4. Determined laydown pattern.		
5. Loaded roof with shingles.		
6. Snapped vertical and horizontal chalklines.		
7. Began positioning and fastening shingles at eaves; worked along the eave to opposite rake. NOTE: All nails should be driven into the shingles above the exposed area of the shingle.		
8. Trimmed shingles at rake.		
9. When starting the second course, cut a strip shingle in half and used as a start at rake. Alternated whole and half shingles at rake as work progressed up roof. NOTE: Follow manufacturer's specification concerning exposure of each shingle.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 63

STRIP LAYING ASPHALT/FIBERGLASS SHINGLES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Continued procedures in item 7 through 9 until the roof was covered.		
11. Checked work area for exposure, security and tears.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

PREPARING FOR THE JOB

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 64

TASK

Construct scaffolding (chicken ladder).

STANDARD OF PERFORMANCE OF TASK

Scaffold must provide a stable work platform, be braced, securely fastened, and must be able to withstand work weight loads.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Carpenter's saw
Clamps
Foldout rule
Hammer
Job specifications
Nails
Steel square

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Recall the degree of a ladder inclined to roof.
3. Identify types of laddered scaffolds.
4. Demonstrate safe work practices.

RESOURCES

Wagner. **Modern Carpentry,** pp. 543-548.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry,** pp. 543-548.
2. Explain materials needed to construct scaffolds.
3. Discuss the purpose of scaffolds.
4. Illustrate complete scaffold set up.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 64

CRITERION-REFERENCED MEASURE

Questions

1. The sides of a ladder are called _________.
2. Single straight ladders are available in sizes _______ ft. to _______ ft.
3. In wooden scaffolds horizontal spacing of support sections should not exceed _______ feet.

Answers

1. Rails
2. 8, 26
3. 8

Practical Application

Have the students construct scaffolding (chicken ladder) to specifications.

Method of Evaluating Practical Application

Use Checklist Performance Objective 64 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 64

CONSTRUCTING SCAFFOLDING (CHICKEN LADDER)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Measured work area where chicken ladder would be used; measured from ridge to lowest part of the work area; extended the measurement by two feet.		
3. Measured and cut two 2" x 4" to length.		
4. Measured and cut 2" x 4" 36 inches long to fit between the two outside frames of chicken ladder.		
5. Positioned and fastened the cross-cuts by driving nails from the outside of the framing 2" x 4" through the cross-cuts. Positioned cross-cuts 24" apart, the length of the outside framing 2" x 4".		
6. Approximated the angle of ridge; cut two 4 foot lengths of 2" x 4" and attached to outside frame of the ladder approximating the angle of ridge.		
7. Checked ladder for bracing, fastening and sturdiness.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 64

CONSTRUCTING SCAFFOLDING (CHICKEN LADDER)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Made adjustments.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 65

TASK

Erect hoists.

STANDARD OF PERFORMANCE OF TASK

Hoist must be stable, carry the design load, reach over the apron and roof, and not damage roof.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Gloves
Grip pliers
Hammer
Manufacturer's specifications
Hard hat
Job specifications
Hand saw
Rope, 50' - 1" diameter

ENABLING OBJECTIVES

1. Interpret plans and specifications.
2. Demonstrate safe work practices.
3. Understand manufacturer's diagrams.

RESOURCE

Feirer. **Carpentry and Building Construction**, p. 528.

TEACHING ACTIVITIES

1. Have the student read and discuss **Carpentry and Building Construction**, p. 528.
2. Explain the purpose of a hoist.
3. Illustrate a hoist completely installed.
4. Discuss safety precautions when erecting hoist.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 65

CRITERION-REFERENCED MEASURE

Questions

1. A __________ is used to raise materials up to a roof.
2. A hoist should be constructed in such a way so it does not __________ the roof.
3. A hoist can be installed on a __________.

Answers

1. Hoist
2. Damage
3. Ladder

Practical Application

Have the students erect a hoist so that it works properly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 65 to determine if the assignment was completed with accuracy.

CHECKLIST FOR PERFORMANCE OBJECTIVE 65

ERECTING HOISTS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications.		
3. Determined and prepared location of the hoist. NOTE: Hoist location will depend on access, type of work, type of equipment and materials to be hoisted, and contour of roof.		
4. Positioned unassembled hoist parts on roof near where hoist would be attached to roof.		
5. Assembled wheel and frame parts of hoist; checked manufacturer's specifications.		
6. Measured, cut and positioned plywood under front and rear stand of hoist to buttress hoist and protect roof.		
7. Set frame and hoist in place.		
8. Loaded rear part of the frame with sufficient weight to serve as a counter balance and keep hoist from tilting.		
9. Inserted rope over hoist pulley wheel.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 65

ERECTING HOISTS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Checked hoist operation.		
11. Made adjustments.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 66

TASK

Load the roof.

STANDARD OF PERFORMANCE OF TASK

Loaded roof must not interfere with work area, must not compromise the structural integrity of roof, and must be sequenced so materials used first are positioned in front.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Job estimate sheet
Job specifications
Sketch of roof work area with pattern of work and roof obstructions

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify pitch of roof.
3. Recall weight of shingles per bundle.
4. Demonstrate safe work practices.

RESOURCE

Feirer. **Carpentry and Building Construction**, pp. 516-530.

TEACHING ACTIVITIES

1. Have students read and discuss **Carpentry and Building Construction**, pp. 516-530.
2. Illustrate the completed roof stocked with shingles.
3. Read and discuss the manufacturer's directions.
4. Discuss the stacking process.
5. Have the students complete the performance task.

PERFORMANCE OBJECTIVE 66

CRITERION-REFERENCED MEASURE

Questions

1. Roof shingles can be loaded by hand or by __________.
2. Regular 3 tab shingles are __________ inches long.
3. __________ should be applied before loading the roof.

Answers

1. Machinery
2. 36"
3. Black felt

Practical Application

Have the students load the roof according to proper loading procedures.

Method of Evaluating Practical Application

Use Checklist Performance Objective 66 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 66

LOADING THE ROOF

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed job estimate sheet to determine equipment and materials to be loaded.		
3. Inspected and prepared roof area for loading.		
4. Determined work areas where specific equipment and materials were to be located.		
5. Placed materials in work area so that first materials to be used were the first available to the workers.		
6. Reviewed roof loading with roofing foreman.		
7. Made adjustments in roof loading.		
8. Cleaned work area.		
9. Cleaned tools and equipment.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 67

TASK

Load/unload trucks.

STANDARD OF PERFORMANCE OF TASK

Materials and equipment must be loaded so that first used is last loaded, there must not be damage to materials or equipment, and truck must not be overloaded.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Canvas cover
Forklift
Job equipment and materials
Job specifications
Pallets
Retaining ropes
Wooden blocks

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify loading procedures.
3. Choose proper area around building.
4. Demonstrate safe work practices.

RESOURCE

Feirer. **Carpentry and Building Construction**, p. 528.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction**, p. 528.
2. Discuss truck loading procedure.
3. Estimate number of bundles of shingles needed.
4. Explain the purpose of a fork lift.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 67

CRITERION-REFERENCED MEASURE

Questions

1. When loading shingles on a truck a _________ is needed at the bottom of the pile.
2. Materials should be covered with a _________.
3. Material should be unloaded where it will be _________ for use.

Answers

1. Pallet
2. Canvas
3. Convenient

Practical Application

Have the students load and unload truck according to acceptable procedures.

Method of Evaluating Practical Application

Use Checklist Performance Objective 67 to determine if the assignment was completed with accuracy.

CHECKLIST FOR PERFORMANCE OBJECTIVE 67

LOADING/UNLOADING TRUCKS

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed job estimate sheet to determine equipment and materials to be used on the job.		
3. Determined size of truck required.		
4. Pre-positioned equipment and materials on loading/unloading area.		
5. Loaded truck; first equipment and materials loaded would be used last.		
6. Adjusted equipment and materials to insure no damage would be done by swaying, vibration or shock.		
7. Used canvas, ropes or retaining guards to cover materials.		
8. Checked load.		
9. Made adjustments.		
10. Cleaned loading/unloading area.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 68

TASK

Perform wind uplift test.

STANDARD OF PERFORMANCE OF TASK

Test must record velocity of wind at which shingles will begin to lift up and velocity at which shingles are damaged.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Calculator
Manufacturer's design specifications
Pencils
Test requirement sheet
Test shingles
Wind tunnel
Wind velocity indicator

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Use velocity indicator.
3. Identify basic equipment needed.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 243-244.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 243-244.
2. Discuss the purpose of a wind uplift test.
3. Demonstrate how to use a wind velocity indicator.
4. Explain how to record test data.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 68

CRITERION-REFERENCED MEASURE

Questions

1. The major piece of equipment needed for a wind uplift test is a ____________________.
2. The speed of the tunnel machine should be increased in increments of __________ mph.
3. Shingles must be applied on a sloped roof a few days before __________.

Answers

1. Velocity indicator
2. 5
3. Testing

Practical Application

Have the students perform wind uplift test, and have them record the velocity of the wind at which shingles will begin to lift up and velocity at which shingles are damaged.

Method of Evaluating Practical Application

Use Checklist Performance Objective 68 to determine if the assignment was completed with accuracy.

CHECKLIST FOR PERFORMANCE OBJECTIVE 68

PERFORMING WIND UPLIFT TEST

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed test requirement sheet.		
2. Extracted test objectives from test set-up.		
3. Affixed shingles to simulated roof.		
4. Positioned simulated roof in wind tunnel.		
5. Activated wind tunnel fan to generate a wind 20 MPH below shingle design specifications.		
6. Increased wind velocity by 5 MPH, observing and recording shingle reaction.		
7. When shingles began to raise from roof, recorded wind velocity.		
8. Continued to increase the wind velocity by 5 mph increments until shingle damage occured.		
9. Recorded wind velocity.		
10. Turned off wind velocity machine.		
11. Recorded test results.		
12. Cleaned tunnel area.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 68

PERFORMING WIND UPLIFT TEST

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Removed simulated roof from the tunnel.		
14. Performed all work in a safe manner. NOTE: Wind velocity tests are not performed by roofers in the field; rather, they are performed by technicians and engineers in the process of developing shingles.		

APPROVED: YES _____ NO ____

Evaluator's Signature   Date

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 69

TASK

Set up a chute.

STANDARD OF PERFORMANCE OF TASK

Chute must be stable and securely fastened to the roof; chute opening must be large enough to accept debris from the roof, and chute must not interfere with work areas.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Blade screwdrivers
Claw hammer
Job specifications
Manufacturer's specifications
Nails
Plywood sheets, 5/8"
Rope, 50 ft., 1" diameter
Studs, 4X4X6

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Read and interpret manufacturer's specifications.
3. Select correct chute location.
4. Demonstrate safe work practices.

RESOURCE

Feirer. **Carpentry and Building Construction**, pp. 544-549.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building Construction**, pp. 544-549.
2. Discuss the need for care when selecting the location of the chute.
3. Demonstrate (with student assistance) the assembly of a chute.
4. Demonstrate the correct method of securing the tail rope to the bottom of the chute.
5. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 69

CRITERION-REFERENCED MEASURE

Questions

1. Before building a chute it is best to determine the __________ of the chute.
2. How is the back end of the platform anchored to the roof?
3. To control the movement of the chute a ____________________ is used by the chute user.

Answers

1. Location
2. With weights
3. Tail rope

Practical Application

Have students set up a chute.

Method of Evaluating Practical Application

Use of Checklist of Performance Objective 69 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 69

SETTING UP A CHUTE

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specification on chute.		
3. Determined location of chute. NOTE: In determining chute location care must be exercised not only where chute will be attached to the roof but also where debris will land after it is put in the chute.		
4. Measured height of the roof where chute was to be attached.		
5. Positioned and nailed the 4X4's to the plywood sheet to form a reinforced platform.		
6. Positioned and set platform on the edge of the roof where chute was to be located; anchored back end of platform with weights. NOTE: Anchor material or weights used on the platform should not be an obstruction nor interfere with chute access.		
7. Attached chute to rope and hoisted chute to pre-positioned area of roof.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 69

SETTING UP A CHUTE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Secured chute to platform using chute chains to wrap around 4X4's.		
9. Stabilized chain positions by using driven nails half bent over the chain links to fasten.		
10. Tied tail rope to bottom of chute. NOTE: Tail rope allows chute user to open and close bottom of chute and also control movement of chute.		
11. Checked chute for security, stability and access.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 70

TASK

Tear off gravel roof.

STANDARD OF PERFORMANCE OF TASK

All debris must be removed down to deck; all obstructions must be cleared, and deck must not be damaged.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 99-100.
Roofers' Local #20. **Joint Apprenticeship Program**, pp. 1-3.

CONDITIONS FOR PERFORMANCE OF TASK

Job specifications
Long handle axe
Power blower
Power broom
Power cutter
Safety glasses
Spud bar
Square shovel
Wheelbarrow
Push broom

ENABLING OBJECTIVES

1. List the steps in the gravel process.
2. Select the proper tools.
3. Recall process for installation.
4. Demonstrate safe work practices.

RESOURCES

1. Feirer. **Carpentry and Building Construction**, pp. 544-549.
2. Wagner. **Modern Carpentry,** pp. 246-248.

TEACHING ACTIVITIES

1. Have the students read and discuss **Carpentry and Building**, pp. 544-549, and **Modern Carpentry**, pp. 246-248.
2. Discuss the rip off process.
3. Review safety rules and regulations.
4. Plan a field trip to a local building site.
5. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 70

CRITERION-REFERENCED MEASURE

Questions

1. The first step to tearing off of gravel roof is to remove the ________.
   a. Gravel
   b. Black felt
   c. Asphalt
2. A ________ is a very important tool needed in the removal of gravel.
3. A ________ ________ is used to remove all dust particles from the roof.

Answers

1. a.
2. Shovel
3. Power blower

Practical Application

Have the students tear off gravel roof so that it will be ready for resurfacing.

Method of Evaluating Practical Application

Use Checklist Performance Objective 70 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 70

TEARING OFF GRAVEL ROOF

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected roof area to determine rip off pattern and condition of roof.		
3. Set up chute.		
4. Broomed gravel into stockpiles by shoveling and brooming.		
5. Loaded gravel into wheelbarrow and shoveled down chute.		
6. Cut the roofing material with a power cutter; cut the roofing material in a checkerboard pattern; kept pieces small enough to fit in chute. CAUTION: WHEN USING CUTTING TOOLS TO SKIM ROOFING MATERIALS, USE CAUTION TO AVOID DAMAGING DECK.		
7. Shoveled and swept roof clear of debris.		
8. Started, positioned and used power blower to remove dust and other fine debris from the roof. Worked the blower nozzle in a sweeping horizontal motion to keep debris in front of the blower. Worked a 3-5 foot section at a time.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 70

TEARING OFF GRAVEL ROOF

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Removed all other roof obstructions, nails, flashing, vent covers and antennas.		
10. Checked roof area.		
11. Removed leftover debris.		
12. Disassembled chute.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 71

TASK

Provide a job estimate.

STANDARD OF PERFORMANCE OF TASK

Estimate must consider costs of all work, equipment, materials, and must not be less than actual job costs required to accomplish the job.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Blueprints
Calculator
Job estimate sheet
Job request requirements
Measuring tape
Pencils

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Recall calculating square feet.
3. Relate labor cost to material cost.

RESOURCE

Lewis. **Basic Construction Estimating**, pp. 59-74.

TEACHING ACTIVITIES

1. Have the students read and discuss **Basic Construction Estimating**, pp. 94-103.
2. Discuss how to do an estimate.
3. Explain how to write up a written agreement.
4. Demonstrate how to do a complete estimate on a given building.
5. Explain how the shape of a roof may cause the price to vary.
6. Have the students to complete the performance of the task.

PERFORMANCE OBJECTIVE 71

CRITERION-REFERENCED MEASURE

Questions

1. Roofing, regardless of type, is estimated by the __________.
2. Each square of shingles will cover __________.
3. Shakes and shingles manufactured from wood are normally from __________ and __________.

Answers

1. Squares
2. 100 sq. ft.
3. Redwood and cedar

Practical Application

Have the students provide a job estimate on roof covering.

Method of Evaluating Practical Application

Use Checklist Performance Objective 71 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 71

PROVIDING A JOB ESTIMATE

Student's Name   Date

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job request.		
2. Visited proposed work site to inspect work area.		
3. Measured to determine and record surface area of the roof to be worked.		
4. Determined and recorded run, span, and, if required, pitch of roof.		
5. Determined and listed the type and amount of materials and equipment required for the job.		
6. Made necessary calculations by determining costs of materials, equipment and labor required for the type of job; taking account into local constraints which may add to cost of the job.		
7. Itemized all job requirements and costs.		
8. Reviewed for accuracy.		
9. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 71

PROVIDING A JOB ESTIMATE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Filled out job estimate sheet; listed all items and costs anticipated.		
11. Prepared to substantiate costs for materials, labor, equipment and time estimates to complete the job.		

APPROVED: YES _____ NO ____

Evaluator's Signature   Date

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 72

TASK

Plan work schedules.

STANDARD OF PERFORMANCE OF TASK

Work schedules must consider all items on the estimate sheet; workers, tools, equipment, and materials must be at the work-site at the time specified, and there must not be conflicts with other jobs.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Calculator
Calendar
Company work projection schedule
Equipment availability schedule
Job estimate sheet
Paper pad
Pencils

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select the basic materials needed.
3. Identify working schedule job related duties.

RESOURCE

Wagner. **Modern Carpentry**, pp. 551-565.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 551-565.
2. Visit a local construction site.
3. Discuss the importance of work scheduling.
4. Demonstrate how to write a time sheet.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 72

CRITERION-REFERENCED MEASURE

Questions

1. Work schedules on roof work may change because of __________.
2. __________ are used to keep accurate time on the job.
3. Daily assignments are needed in order that the job be __________.

Answers

1. Weather
2. Time sheets
3. Productive

Practical Application

Have the students plan a work schedule so that it fits the needs of a construction crew.

Method of Evaluating Practical Application

Use Checklist Performance Objective 72 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 72

PLANNING WORK SCHEDULES

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job estimate sheet requirements.		
2. Reviewed work activities with job requester.		
3. Prepared work schedules based upon job estimate sheets and interview with job requester.		
4. Scheduled work assignments based on availability of personnel.		
5. Issued daily work assignments based upon job requirements and availability of personnel.		
6. Inventoried materials and equipment required for the job. Checked the company work projection schedule for conflicts.		
7. Ordered materials if not available.		
8. Insured equipment availability.		
9. Reviewed work schedules with supervisor for approval.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 72

PLANNING WORK SCHEDULES

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Made adjustments to work schedule.		
11. Printed/posted work schedules on company work projection schedule.		
12. Notified job requester of schedule.		

APPROVED: YES ____ NO ____

Evaluator's Signature ______ Date ______

DUTY PREPARING FOR THE JOB

PERFORMANCE OBJECTIVE 73

TASK

Prepare deck for re-roofing.

STANDARD OF PERFORMANCE OF TASK

All debris and obstructions must be removed, and deck must not be damaged.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Carpenter's level
Debris containers
Filler materials (putty, wood glue, felt, etc.)
Job requirements
Long handle axe
Power blower
Power cutter
Push broom
Safety glasses
Spud bar
Square shovel
Wheelbarrow

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify the need to re-roof.
3. Recall the re-roofing process.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 245-260.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 245-260.
2. Explain the tear off process.
3. Illustrate the process for cleaning up debris.
4. Take a field trip to a nearby building site.
5. Prepare a deck for re-roofing.
6. Review shingling process.
7. Have the students complete the performance of the tasks.

PERFORMANCE OBJECTIVE 73

CRITERION-REFERENCED MEASURE

Questions

1. All loose debris should be moved from the deck by sweeping and/or using a ____________________.
2. When re-roofing is done on a deck, it should be checked for __________ boards.
3. Two rows of rails are needed to install the ____________________.

Answers

1. Power blower
2. Rotten
3. Starter strip

Practical Application

Have the students prepare deck for re-roofing by making sure all debris and obstructions are removed and the deck is not damaged.

Method of Evaluating Practical Application

Use Checklist Performance Objective 73 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 73

PREPARING DECK FOR RE-ROOFING

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job requirements.		
2. Inspected roof area to determine degree of preparation involved.		
3. Tore off old roofing. CAUTION: WHEN USING CUTTING TOOLS FOR ROOF TEAR-OFF, USE CAUTION TO AVOID DAMAGING DECK.		
4. Removed roof obstructions, nails, flashing, and antennas.		
5. Removed all loose debris from deck by sweeping and power blowing.		
6. Located and filled in low spots, nicks and gouges with filler materials.		
7. Checked deck for obstructions and damage.		
8. Made adjustments.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 74

TASK

Adjust mini-mopper spray.

STANDARD OF PERFORMANCE OF TASK

Spray exit must be uniform with no voids in spray flow.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Crescent wrench
Gloves
Hot bitumen
Manufacturer's specification
Pliers
Rubber boots
Safety glasses

ENABLING OBJECTIVES

1. Read and interpret manufacturer's specifications.
2. Select area to be sprayed.
3. Demonstrate safe work practices.

RESOURCE

Operator Instruction Manual. Garlock Equipment Company.

TEACHING ACTIVITIES

1. Have students read the section on the mini-mopper spray in the Garlock Equipment Company **Operator Instruction Manual**.
2. Identify the mini sprayer parts and how the sprayer operates.
3. Demonstrate the assembly and disassembly of the mini-sprayer.
4. Demonstrate filling the mini-sprayer hopper.
5. Demonstrate using the mini-sprayer while adjusting the spray flow by adjusting the screw setting.
6. Have students practice spraying bitumen using the mini-sprayer.

PERFORMANCE OBJECTIVE 74

CRITERION-REFERENCED MEASURE

Questions

1. What type of roofing material is used in the mini-mopper spray?
2. How is the flow controlled when using the mini-mopper spray?
3. After using the mini-mopper spray, what should be done with the equipment?

Answers

1. Bitumen
2. By turning the adjusting screws.
3. Always clean the mini-mopper spray after each use.

Practical Application

Have students adjust mini-mopper spray.

Method of Evaluating Practical Application

Use of Checklist of Performance Objective 74 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 74

ADJUSTING MINI-MOPPER SPRAY

Student's Name ____________________ Date ____________

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Inspected mini-mopper spray.		
2. Reviewed manufacturer's specification on spray adjustment.		
3. Filled the mini-mopper hopper to 1/4 full. CAUTION: USE EXTREME CARE AND WEAR PROTECTIVE CLOTHING WHEN HANDLING HOT BITUMEN.		
4. Located area where spray can be activated.		
5. Activated mini-mopper, observing bitumen flow through jets.		
6. Adjusted screws to alter spray pattern.		
7. Repeated items 5 and 6 until desired spray pattern was achieved.		
8. Turned off mini-mopper.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature ____________________ Date ____________

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 75

TASK

Adjust the carburetor.

STANDARD OF PERFORMANCE OF TASK

Carburetor must pass air-fuel mixture which is not too lean nor too rich, and the engine must not run rough or overheat.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Blade screwdrivers
Manufacturer's specification
Open end wrenches
Phillips head screwdriver
Gasoline engine with carburetor

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify problems with carburetor running.
3. Select basic tools needed.
4. Demonstrate safe work practices.

RESOURCE

Toboldt. **Automotive Encyclopedia**, pp. 275-282.

TEACHING ACTIVITIES

1. Have the students read and discuss **Automotive Enclyclopedia**, pp. 275-282.
2. Explain the carburetor adjustment process.
3. Illustrate the trouble shooting process.
4. Draw a schematic on carburetor adjustments.
5. Have the students adjust the carburetor.

PERFORMANCE OBJECTIVE 75

CRITERION-REFERENCED MEASURE

Questions

1. Which should be adjusted first, the ignition or carburetor?
2. Before attempting to adjust the air-fuel mixture, it is necessary to adjust engine __________ speed.
3. A ______________________ driver is needed to adjust carburetor.

Answers

1. Ignition
2. Idle
3. Blade screw

Practical Application

Have the students adjust the carburetor so that the engine runs smoothly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 75 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 75

ADJUSTING THE CARBURETOR

Student's Name Date

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Shut down engine.		
2. Reviewed manufacturer's specifications.		
3. Gained access to the carburetor by removing access panels.		
4. Located idling and adjusting screws on carburetor.		
5. Started engine, kept controls in neutral, and allowed engine to idle.		
6. Rotated idling and gas adjustment screws on carburetor; listened for the engine to stop running rough. Continued turning the adjustment screw until engine ran rough again.		
7. Backed off adjustment screw until engine ran smoother than the rough area encountered during start and when over-adjustment occurred.		
8. Activated accelerator, checking for engine roughness under several demands for gas.		
9. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 75

ADJUSTING THE CARBURETOR

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Shut down engine.		
11. Replaced access panels.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 76

TASK

Change oil.

STANDARD OF PERFORMANCE OF TASK

Oil must be of type and quality specified by manufacturer; oil plug must not leak.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Funnel
Manufacturer's specifications
Oil drain pan
Oil spout with opener
Open end wrenches
Wiping rags
Gasoline engine

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Use proper wrenches.
3. Identify parts of the engine.
4. Demonstrate safe work practices.

RESOURCE

Miller, et al. **Small Gasoline Engines**, pp. 297-302.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines**, pp. 297-302.
2. Discuss the importance of changing the oil periodically.
3. Demonstrate the oil changing process.
4. Discuss the characteristics of burned and overused oil.
5. Have the students demonstrate their ability to change oil in a small engine.

PERFORMANCE OBJECTIVE 76

CRITERION-REFERENCED MEASURE

Questions

1. In order to change the oil, it is necessary to locate the __________ __________.
2. Oil should be checked every __________ hours of engine operations.
3. Oil should be changed while the engine is __________.

Answers

1. Drain plug
2. 5
3. Warm

Practical Application

Have the students change oil according to manufacturer's handbook.

Method of Evaluating Practical Application

Use Checklist Performance Objective 76 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 76

CHANGING OIL

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed manufacturer's specifications.		
2. Located oil drain plug and positioned oil drain pan underneath plug.		
3. Removed oil drain plug allowing oil to drain into pan.		
4. Replaced plug after oil was drained; did not overtighten the plug.		
5. Selected type and quantity of oil required by manufacturer's specifications.		
6. Removed oil cover from access vent.		
7. Positioned oil spout in access vent and allowed oil to drain into unit.		
8. Repeated item 7 until correct amount of oil had been put in unit.		
9. Replaced access vent cover.		
10. Wiped oil spills.		
11. Checked oil plug for leaks.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 77

TASK

Change spark plug.

STANDARD OF PERFORMANCE OF TASK

Spark plug must not be cross-threaded or damaged and must be torqued according to manufacturer's specifications.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Blade screwdriver
Manufacturer's specifications
Phillips head screwdriver
Spark plug socket wrench
Straight pliers
Torque wrench
Gasoline engine

ENABLING OBJECTIVES

1. Read and interpret job specification.
2. Select proper hand tools.
3. Identify the need of the spark plug.
4. Demonstrate safe work practices.

RESOURCE

Miller, et al. **Small Gasoline Engines**, pp. 165-170.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines**, pp. 165-170.
2. Discuss the importance of changing spark plugs.
3. Demonstrate the proper use of hand tools.
4. Explain how to determine whether a plug is good or bad.
5. Have the students complete the performance of task.

PERFORMANCE OBJECTIVE 77

CRITERION-REFERENCED MEASURE

Questions

1. There are at least __________ types of plugs used in small engines.
2. A ______________________ is highly recommended to remove a plug.
3. Before changing spark plugs, the engine must be __________.

Answers

1. Five
2. Socket wrench
3. Cooled

Practical Application

Have the students replace a bad spark plug with a good spark plug so that engine operates properly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 77 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 77

CHANGING SPARK PLUGS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed manufacturer's specifications on spark plugs.		
2. Insured engine was shut down and ignition was turned off. CAUTION: ALLOW ENGINE TIME TO DISSIPATE HEAT PRIOR TO CHANGING THE SPARK PLUGS; HOT ENGINES CAN CAUSE BURNS.		
3. Gained access to spark plug by removing or opening access panels.		
4. Removed spark plug lead wire from head of spark plug.		
5. Fitted spark plug socket wrench over spark plug, insured proper seat, and applied counterclockwise pressure; continued rotation until plug was free of threads.		
6. Removed spark plug from socket.		
7. Replaced plug by inserting new plug gently into plug port and rotating clockwise until thread was caught; continued clockwise rotation until plug was firmly seated.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 77

CHANGING SPARK PLUGS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
8. Used torque wrench to seat plug according to manufacturer's torque requirements.		
9. Connected spark plug lead wire to plug head.		
10. Replaced access panels.		
11. Checked for performance.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 78

TASK

Clean air filter.

STANDARD OF PERFORMANCE OF TASK

Filter must be devoid of visible dirt and lint; it must be mechanically secured.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Air pressure hose
Blade screwdriver
Cleaning solution
Manufacturer's specifications
Phillips head screwdriver
Water hose
Wiping rags
Gasoline engine

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select proper tools for job.
3. Recall parts of small engine.
4. Demonstate safe work practices.

RESOURCE

Stephenson. **Small Gasoline Engines,** IV Edition, pp. 166-169.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines,** pp. 166-169.
2. Explain the purpose of cleaning an air filter.
3. Discuss the characteristics of a stopped up air filter.
4. Demonstrate the disassembling of an air filter.
5. Demonstrate the cleaning of an air filter.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 78

CRITERION-REFERENCED MEASURE

Questions

1. A clogged air filter restricts the air ________.
2. Air filters can be cleaned with air pressure and a cleaning ________.
3. Some air filters are made of ________________.

Answers

1. Flow
2. Solution
3. Polyurethane foam

Practical Application

Have the students clean an air filter so that the engine operates properly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 78 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 78

CLEANING AN AIR FILTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed manufacturer's specifications on air filters.		
2. Insured power equipment was shut down with ignition turned off.		
3. Removed panels to gain access to filter.		
4. Removed filter cover and removed filter element.		
5. Gently tapped filter on the side to shake loose dirt or lint.		
6. Cleaned filter by applying cleaning solution and spraying with water or blasting with air, depending on type of filter and manufacturer's specifications.		
7. Shaked filter to remove excess water or cleaning solution.		
8. Allowed filter to dry.		
9. Replaced filter element in filter housing and secured filter cover.		
10. Replaced access panels.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 78

CLEANING AN AIR FILTER

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Tested for performance.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 79

TASK

Clean contact points.

STANDARD OF PERFORMANCE OF TASK

Points must be free of carbon deposits, pits and burns; points must make total surface contact with each other.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Blade screwdriver
Contact point file
Manufacturer's specifications
Point gapper
Phillips head screwdriver
Pliers
Small bristle brush

ENABLING OBJECTIVES

1. Read and interpret manufacturer's specifications.
2. Demonstrate knowledge of combustion engine.
3. Demonstrate safe work practices.

RESOURCE

Miller. **Small Gasoline Engines**, pp. 164-170.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines**, pp. 164-170.
2. Have the students look up the manufacturer's recommended gap setting for the points of specified engines.
3. Demonstrate the correct method of removing a rotor.
4. Discuss with the students how to determine when the points should be cleaned.
5. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 79

CRITERION-REFERENCED MEASURE

Questions

1. To set the proper gap on the points it is best to check the __________ specifications.
2. Points are usually found on the __________.
3. Carbon build-up is a common reason to clean and re-gap the points. True or False?

Answers

1. Manufacturer's
2. Rotor
3. True

Practical Application

Have students clean contact points.

Method of Evaluating Practical Application

Use of Checklist of Performance Objective 79 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 79

CLEANING CONTACT POINTS

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed manufacturer's specifications on contact points.		
2. Shut down power equipment and turned ignition off.		
3. Removed access panel to distributor.		
4. Removed distributor cap by unsnapping side spring releases.		
5. Removed points from distributor.		
6. Examined points to determine if there were any burn marks, carbon build-up or if points were worn in specific area.		
7. Brushed carbon deposits with bristle brush.		
8. Filed and brushed points to remove any deposits and filed straight to insure total surface contact.		
9. Replaced points on rotor.		
10. Gapped the points to specified gap.		
11. Replaced distributor cap.		
12. Tested for performance.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 79

CLEANING CONTACT POINTS

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
13. Made adjustments.		
14. Replaced access panels.		
15. Cleaned work area.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 80

TASK

Clean fuel filter.

STANDARD OF PERFORMANCE OF TASK

Filter must not have visible trace of dirt or debris; the fuel must flow through filter freely and must not leak.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

- Air pressure hose
- Blade screwdriver
- Cleaning solution
- Manufacturer's specifications
- Open end wrenches
- Phillips head screwdriver
- Pliers
- Small bristle brush
- Water hose
- Wiping rags
- Wooden plug
- Gasoline engine

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Use proper hand tools.
3. Recall parts of the engine.
4. Demonstrate safe work practices.

RESOURCE

Stephenson. **Small Gasoline Engines**, IV Edition, pp. 53-68.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines**, IV Edition, pp. 53-68.
2. Discuss characteristics of a clogged fuel filter.
3. Demonstrate checking for a clogged fuel filter.
4. Discuss the importance of keeping a fuel filter clean.
5. Explain some disadvantages of a clogged fuel filter.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 80

CRITERION-REFERENCED MEASURE

Questions

1. The ______ ______ filters out dirt, allowing only clean fuel to enter the fuel line.
2. Fuel filters must be cleaned with cleaning solution and water or ______, depending on the type of filter.
3. Allow the filter to dry completely before ______.

Answers

1. Fuel filter
2. Air
3. Reassembling

Practical Application

Have the students clean a fuel filter so that the fuel flows through properly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 80 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 80

CLEANING A FUEL FILTER

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed manufacturer's specification on fuel filter.		
2. Insured engine was shut-down with ignition turned off.		
3. Removed access panels to fuel filter.		
4. Located the fuel filter.		
5. Disconnected the fuel line leading to the filter. Inserted a wooden plug in the end of the open fuel line. CAUTION: EXERCISE CAUTION WHEN DISCONNECTING FUEL LINES WHILE THE ENGINE IS STILL HOT.		
6. Removed the filter from the fuel line.		
7. Cleaned the filter by applying a cleaning solution of water or air depending on the type of fuel filter and manufacturer's specifications.		
8. Allowed filter to dry.		
9. Replaced fuel filter in fuel filter cavity.		
10. Removed plug from end of open fuel line and reconnected fuel line to filter cavity.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 80

CLEANING A FUEL FILTER

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Replaced access panels.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 81

TASK

Clean portable tools (hand, power).

STANDARD OF PERFORMANCE OF TASK

Tools must be devoid of foreign matter; power equipment must be lubricated.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Air hose
Cleaning oil
Cleaning solution
Grease cartridge
Grease gun
Manufacturer's specifications
Hand scraper
Hand wire brush
Hand bristle brush
Water bucket
Water hose
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify hand and power tools.
3. Use maintenance and owner's manuals correctly.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 37-78.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 37-78.
2. Explain the purpose of cleaning hand and power tools.
3. Demonstrate how to clean tools.
4. Discuss safety precautions.
5. Have the students demonstrate the performance of task.

PERFORMANCE OBJECTIVE 81

CRITERION-REFERENCED MEASURE

Questions

1. In order to maintain tools properly, one must be familiar with the way they ________.
2. When cleaning power tools they must be ________.
3. Tools must be stored in their proper ________ places.

Answers

1. Operate
2. Unplugged
3. Storage

Practical Application

Have the students care for selected portable tools (hand/power) so that they are clean and in good working condition.

Method of Evaluating Practical Application

Use Checklist Performance Objective 81 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 81

CLEANING PORTABLE TOOLS (HAND, POWER)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed manufacturer's specifications regarding cleaning and lubricating portable power tools.		
2. Laid out and inspected tools to determine the type of cleaning required.		
3. Positioned and laid out tools and cleaning solution near drain area.		
4. Applied cleaning solution to tools requiring the solution.		
5. Wired brushed, bristle brushed and hand scraped tools to remove foreign matter.		
6. Rinsed tools with water.		
7. Repeated items 4 through 6 until all tools were free of foreign matter.		
8. Dried tools by wiping down or air hosing.		
9. Lubricated power tools by using grease gun in areas specified by manufacturer.		
10. Rubbed thin coating of oil on all exposed tool faces.		
11. Checked tools for foreign matter and lubrication.		

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 82

TASK

Record daily engine operating hours.

STANDARD OF PERFORMANCE OF TASK

Daily record must be readable and reflect actual engine running time.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Engine operating log
Pencil
Timing device

ENABLING OBJECTIVES

1. Knowledge of engine start-up/shut-down procedures.
2. Demonstrate safe work practices.

RESOURCE

Stephenson. **Small Gasoline Engines,** IV Edition, pp. 52-70.

TEACHING ACTIVITIES

1. Have the students read and discuss **Small Gasoline Engines,** pp. 52-70.
2. Review basic math (addition, subtraction, etc.) with students.
3. Discuss the information required on the engine operating log.
4. Demonstrate the correct method to calculate engine run time.
5. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 82

CRITERION-REFERENCED MEASURE

Questions

1. A good preventive maintenance program requires that a __________ be kept of the engine run time.
2. Engine run time is calculated by using the engine __________ time and the engine ____________________ time.
3. Another way of calculating engine run time is to log the number of miles it is used. True or false?

Answers

1. Log
2. Start, shut down
3. False

Practical Application

Have students record daily engine operating hours.

Method of Evaluating Practical Application

Use of Checklist of Performance Objective 82 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 82

RECORDING DAILY ENGINE OPERATING HOURS

Student's Name **Date**

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Prior to starting engine set engine timer or recorded time according to the clock.		
2. Recorded time on engine operating log; included date and time engine was started.		
3. When engine was shut down, recorded engine run time as indicated by engine run clock or if engine run clock was not available, checked time engine shut-down.		
4. Calculated engine run time from engine start to engine shut-down.		
5. Recorded engine shut-down time and engine run time. Recorded by date and time.		
6. Repeated items 1 through 5 for each engine start and engine shut-down.		
7. At the end of the day, added total engine run time, recorded it on daily engine time, and initialed the log.		
8. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 83

TASK

Replace pulley belts on power equipment.

STANDARD OF PERFORMANCE OF TASK

Belts must be aligned with pulley wheels, have no splits, and belt tension must conform to the manufacturer's specifications.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Assorted Allen wrenches
Assorted open end wrenches
Blade screwdrivers
Manufacturer's specifications
Phillips head screwdrivers
Pliers

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Read and interpret manufacturer's specifications.
3. Select and use proper tools.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 36-80.

TEACHING ACTIVITIES

1. Have the students read and discuss **Modern Carpentry**, pp. 36-80.
2. Discuss the need for reviewing the manufacturer's specifications before replacing defective pulley belts.
3. Demonstrate the correct method of removing a defective belt.
4. Demonstrate and discuss setting the proper tension on a belt.
5. Have the students complete the performance steps of the task.

PERFORMANCE OBJECTIVE 83

CRITERION-REFERENCED MEASURE

Questions

1. When replacing a defective pulley belt it is best to disconnect the power to the unit. True or false?
2. A defective belt may cause:
   a. Motor problems
   b. Inconvenience
   c. Either a or b
   d. Neither a nor b
3. The mounting bracket should be tightened
   a. Before the belt is tightened.
   b. After the belt is tightened.
   c. Either a or b.
   d. Neither a nor b.

Answers

1. True
2. d
3. b

Practical Application

Have students replace pulley belts on power equipment.

Method of Evaluating Practical Application

Use of Checklist of Performance Objective 83 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 83

REPLACING PULLEY BELTS ON POWER EQUIPMENT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed the manufacturer's specifications on pulley belts.		
2. Disconnected the power to unit.		
3. Removed panels to gain access to pulley belts.		
4. Loosened pulley mounting bracket and removed defective belt.		
5. Installed replacement belt by positioning over pulley wheels.		
6. Adjusted belt tension by moving mounting bracket. When tension was achieved, tightened the mounting bracket.		
7. Visibly checked alignment of belt and pulleys.		
8. Started engine.		
9. Checked belt operation.		
10. Made adjustments.		
11. Shut down unit.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 83

REPLACING PULLEY BELTS ON POWER EQUIPMENT

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Replaced access panels.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT

PERFORMANCE OBJECTIVE 84

TASK

Sharpen blades.

STANDARD OF PERFORMANCE OF TASK

Blades must be free of nicks; cutting edge must be straight, and the angle of the cutting edge must be in accordance with manufacturer's specifications.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Assorted files
Assorted grain sandpaper
Assorted rags
Manufacturer's specifications
Grinding wheel
Machinist's vise
Cleaning oil
Wire hand brush

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Identify the need to sharpen tools.
3. Use sharpening tool correctly.
4. Demonstrate safe work practices.

RESOURCE

Wagner. **Modern Carpentry**, pp. 37-54.

TEACHING ACTIVITIES

1. Have students read and discuss **Modern Carpentry**, pp. 37-54.
2. Explain the purpose of sharpening blades.
3. Discuss the importance of checking a blade for dullness.
4. Explain the disadvantage of dull blades.
5. Have the students complete the performance of task.

PERFORMANCE OBJECTIVE 84

CRITERION-REFERENCED MEASURE

Questions

1. To sharpen blades properly it would be best to have an assortment of __________.
2. Blades should be sharpened according to the ____________________.
3. Badly nicked blades may require the use of a __________.

Answers

1. Files
2. Manufacturer's specifications
3. Grinder

Practical Application

Have the students sharpen blades so that they meet the manufacturer's specifications.

Method of Evaluating Practical Application

Use Checklist Performance Objective 84 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 84

SHARPENING BLADES

Student's Name　　　　　　　　　　Date

DIRECTIONS TO STUDENT: Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR: Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed manufacturer's specifications for sharpening blades.		
2. Inspected the blades for nicks and the degree of dullness.		
3. Removed blades and anchored in a vise.		
4. Rough filed or ground the blades to remove the nicks; ground or filed evenly to keep the blade straight.		
5. Fine filed or ground the blade to hone the cutting edge; used the procedures outlined by the manufacturer. Continued the filing/grinding process until desired sharpness was acquired.		
6. Wiped a thin layer of oil on the blade.		
7. Cleaned work area.		
8. Stored blades.		
9. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature　　　　　　　　　　Date

OPERATING TANKERS, KETTLES

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 85

TASK

Assemble/disassemble hot conduit.

STANDARD OF PERFORMANCE OF TASK

Conduit must be stable; not leak while operating.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Burner
Butane tank
Can of oil
Job specifications
Leak cloth
Measuring tape
Pipe wrenches, 18"
Rope, 50 ft, 1" diameter
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall the measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 6.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, p. 6.
2. Explain why it is necessary to disassemble the conduit when it is hot.
3. Discuss all safety procedures for assembling and disassembling conduit.
4. Prepare a schematic of conduit assembly.
5. Plan and organize a field trip to a job site to view a conduit setup.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 85

CRITERION-REFERENCED MEASURE

Questions

1. If the tubing is more horizontal it requires less support. True or False?
2. State the first step needed for a safe operation.
3. O.S.H.A. requires that a guard rail with a minimum of __________ be set-up where hot material is discharged.

Answers

1. False
2. Check for cracks or bends
3. 4 (four) feet

Practical Application

Have the students assemble/disassemble a hot conduit; conduit must be stable and not leak while operating.

Method of Evaluating Practical Application

Use Checklist Performance Objective 85 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 85

ASSEMBLING/DISASSEMBLING HOT CONDUIT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Determined setup area to assemble conduit.		
3. Measured height of the building where conduit was to be located.		
4. Laid conduit lengths and connectors to be attached to the building.		
5. Attached the sections of conduit and connectors to desired length.		
6. Attached flex hose to the top of conduit.		
7. Positioned and secured leak cloth around conduit at each seam.		
8. Attached a rope around the conduit approximately 1/3 from the top of conduit.		
9. Positioned the conduit perpendicular to the building; positioned rope up to roof area where conduit would be attached.		
10. Stood conduit near the vertical using rope and personnel to guide the conduit into position.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 85

ASSEMBLING/DISASSEMBLING HOT CONDUIT

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Positioned and attached lower end of conduit to the kettle or funnel.		
12. Attached braces to conduit at roof position area and every 10' of conduit; attached braces to the eaves and wall, or positioned on the ground, depending on the lay of land.		
13. Checked conduit for stability and leaks.		
14. Made adjustments.		
15. Disassembled conduit, allowed hot material to evacuate from conduit, and disassembled following items 5 through 12 in reverse order.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 86

TASK

Attach LP lines to kettle.

STANDARD OF PERFORMANCE OF TASK

Lines must not leak or be cross threaded.

SOURCE OF STANDARD

Writing Team State of Georgia

CONDITIONS FOR PERFORMANCE OF TASK

Assorted open-end wrenches
Job specifications
Leak detector
Pliers

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall the measurements of length using the ruler.
4. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 4.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, p. 4.
2. Explain the correct procedure for attaching L.P. lines.
3. Demonstrate the use of a leak detector.
4. Prepare a handout on kettles with L.P. lines highlighted.
5. Have the students read and discuss safety rules for attaching L.P. lines.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 86

CRITERION-REFERENCED MEASURE

Questions

1. Pumping bitumen below flues is an accepted practice. True or False?
2. When lighting tank, a wand soaked with __________ should be used.
3. When shutting down burners on kettles, one should burn out all gas before disconnecting lines. True or false?

Answers

1. False
2. Kerosene
3. True

Practical Application

Have the students attach LP lines to kettle; lines must not leak or be cross threaded.

Method of Evaluating Practical Application

Use Checklist Performance Objective 86 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 86

ATTACHING LP LINES TO KETTLE

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Laid out LP lines near connecting attachments.		
3. Determined which lines went on which connector.		
4. Inserted LP line with adapter into tank receptacle.		
5. Slid coupler from line to tank and tightened. CAUTION: EXERCISE CARE WHEN INITIATING COUPLING PROCEDURES SO AS NOT TO CROSS THREAD COUPLING.		
6. Inspected coupling for security.		
7. Tested for leaks.		
8. Made adjustments.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 87

TASK

Clean the kiln.

STANDARD OF PERFORMANCE OF TASK

Kiln and flues must be free of carbon and debris; flues and kiln must not be damaged.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Adjustable wrench
Butane tank with burner
Claw hammer
Come-a-long
Gloves
Job specifications
Manufacturer's specifications
Long handle axe
Power chisel
Rubber boots
Safety glasses
Short handled shovel
Wire brush
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual,** p. 7.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual,** p. 7.
2. Have the students prepare a list of tools needed to clean kettle.
3. Discuss manufacturer's specifications for cleaning the kiln.
4. Demonstrate proper procedures for removing flues from kettle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 87

CRITERION-REFERENCED MEASURE

Questions

1. State two reasons for cleaning the kettle.
2. What may occur when kettle needs cleaning?
3. What is the cause of reduced tube life?

Answers

1. Fire hazzards, heat loss
2. Flashing
3. Carbon build-up

Practical Application

Have the students clean the kiln so that flues are free of carbon and debris and are not damaged in the process.

Method of Evaluating Practical Application

Use Checklist Performance Objective 87 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 87

CLEANING THE KILN

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications.		
3. Inspected and prepared kiln for cleaning by keeping kiln temperatures sufficient to prevent hot bitumen from solidifying. CAUTION: USE EXTREME CAUTION AND PROTECTIVE CLOTHING WHEN WORKING WITH HOT BITUMEN.		
4. Removed lid bolts and lid from kettle.		
5. Removed flue bolts.		
6. Disconnected pump.		
7. Removed the flues from kettle.		
8. Allowed kiln sufficient time to cool to the touch.		
9. Chipped large carbon deposits from flues and kettle. CAUTION: EXERCISE CARE IN THE CHIPPING PROCESS; DO NOT ALLOW CHISELS TO PUNCTURE FLUES OR KILN.		
10. Used a wire brush to scour the flues and kettles.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 87

CLEANING THE KILN

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Repeated items 9 and 10 until flues and kettle were clean of carbon deposits and debris.		
12. Removed loose carbon and hot deposits from bottom of kettle.		
13. Checked kettle and flues for cleanliness, buckling, holes, or bulges.		
14. Made adjustments.		
15. Reassembled kiln.		
16. Cleaned work area.		
17. Cleaned tools and equipment.		
18. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature

Date

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 88

TASK

Clean the tank.

STANDARD OF PERFORMANCE OF TASK

Tank must be free of carbon deposits and debris and not be damaged during the cleaning operation.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Adjustable wrench
Bucket
Butane tank with burner
Claw hammer
Come-a-long
Extension light
Flashlight
Long handle axe
Job specifications
Gloves
Power chisel
Respirator
Rubber boots
Safety glasses
Short handle shovel
Wire brush

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, pp. 7-8.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, pp. 7-8.
2. Discuss safety rules.

PERFORMANCE OBJECTIVE 88

TEACHING ACTIVITIES (Continued)

3. Demonstrate correct procedure for cleaning tank.
4. Have the students prepare a list of tools and safety equipment needed to clean tank.
5. Have the students complete the performance of the task.

CRITERION-REFERENCED MEASURE

Questions

1. What is the first step in cleaning the tank?
2. What tool is needed to scour inside of tank?
3. What should be used to prevent inhaling dust and debris?

Answers

1. Tilt kettle and drain completely while hot.
2. Wire brush
3. Respirator

Practical Application

Have the students clean the tank so that it will be free of carbon deposits and debris and not be damaged during the cleaning operation.

Method of Evaluating Practical Application

Use Checklist Performance Objective 88 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 88

CLEANING THE TANK

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications.		
3. Inspected tank to insure tank was disconnected from gas conduit.		
4. Insured tank was stable.		
5. Unlatched and opened tank lid.		
6. Entered tank feet first by climbing into open lid hole.		
7. Used a flashlight or extension light and inspected inside tank. CAUTION: WORKING INSIDE TANK USE A RESPIRATOR TO PREVENT INHALING DUST AND DEBRIS.		
8. Began chipping carbon and debris from the inside of tank. CAUTION: DO NOT DAMAGE TANK WHILE CHIPPING.		
9. Scoured inside of the tank with a wire brush.		
10. Repeated items 8 and 9 until tank was free of carbon and debris.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 88

CLEANING THE TANK

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Removed accumulated debris from the bottom of tank.		
12. Checked inside of tank for cleanliness, cracks, gouges, or bulges.		
13. Made adjustments.		
14. Cleaned work area.		
15. Climbed out of tank.		
16. Cleaned tools and equipment.		
17. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature

Date

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 89

TASK

Fire a kerosene-fed kettle.

STANDARD OF PERFORMANCE OF TASK

Kettle must not contain excessive kerosene in burner chamber; flame must be even and respond to adjustments.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Fire extinguisher
Job specifications
Manufacturer's specification
Matches

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Galrock. **Operator Instruction Manual**, p. 4.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, p. 4.
2. Discuss proper procedure for preparing to fire kerosene burner.
3. Demonstrate how to properly fill tank with kerosene.
4. Explain the P.S.I. settings for tank.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 89

CRITERION-REFERENCED MEASURE

Questions

1. The tank should be filled to within __________ inches of the top.
2. What is the minimum P.S.I. setting to operate safely?
3. How often should the burner nozzle be cleaned for the most efficient operation?

Answers

1. 3
2. 20 to 25 P.S.I.
3. Once a week

Practical Application

Have the students fire a kerosene-fed kettle. Kettle must not contain excessive kerosene in burner chamber and flame must be even and respond to adjustments.

Method of Evaluating Practical Application

Use Checklist Performance Objective 89 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 89

FIRING KEROSENE-FED KETTLE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications for firing a kerosne-fed kettle.		
3. Checked kettle for fuel, wick, and residual kerosene.		
4. Primed kettle by pumping pressurized air into the fire chamber; opened fuel line no more than 1/4 turn.		
5. Observed wick for saturation of kerosene. CAUTION: NEVER LOOSEN CAP ON THE FUEL TANK WHEN AIR IS UNDER PRESSURE AND BURNER IS LIGHTED. THIS CAN CAUSE KEROSENE TO SPRAY OUT, IGNITE, AND CAUSE THE HOT AIR TO FLASH.		
6. Ignited fuel.		
7. Adjusted fuel and air to desired flame length.		
8. Closed igniter door.		
9. Monitored kettle while in use.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 90

TASK

Fire a kettle (manual/automatic).

STANDARD OF PERFORMANCE OF TASK

Flame in kettle must burn evenly and respond to adjustments.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Face shield
Fire extinguisher
Igniter
Job specifications
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 2.

TEACHING ACTIVITIES

1. Have the students read Garlock, **Operator Instruction Manual**, p. 2.
2. Discuss the proper safety rules for firing kettles.
3. Demonstrate procedure for lighting pilot.
4. Explain the various parts of automatic burner control.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 90

CRITERION-REFERENCED MEASURE

Questions

1. How many people are needed to start a pilot light?
2. What can happen if heat is not raised in 50° increments?
3. The valve used in lighting the pilot is a __________ valve.

Answers

1. Two people
2. Hot spot, uneven heating and possibility of fire.
3. Baso valve

Practical Application

Have the students fire a manual or automatic kettle so that the flame in the kettle will burn evenly and respond to adjustments.

Method of Evaluating Practical Application

Use Checklist Performance Objective 90 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 90

FIRING KETTLE (MANUAL/AUTOMATIC)

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufaturer's specifications.		
3. Inspected kettle to insure drafts were open, fuel lines were connected to the kettle, and there were no fuel leaks.		
4. Opened flue vents.		
5. Rotated gas control to low or start.		
6. Opened burner chamber, inserted igniter and ignited.		
7. Adjusted flame to proper height and color. NOTE: After ignition check fuel lines for leaks, frosting or icing around the connectors. CAUTION: IF ANY FUEL ODOR IS DETECTED IN THE VICINITY OF THE KETTLE, SHUT OFF FUEL IMMEDIATELY.		
8. Closed igniter access.		
9. Stored igniter.		
10. Monitored kettle while in use.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 91

TASK

Level the kettle.

STANDARD OF PERFORMANCE OF TASK

Kettle must appear level. Hot tar in tank must indicate tank is level, and carpenter's level must indicate kettle is level.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Carpenter's level
Jacks
Job specifications
Manufacturer's specification
Stabilizing arms
Wheel blocks
Wooden blocks

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, pp. 2-3.

TEACHING ACTIVITIES

1. Have the students read and discuss kettle leveling in Garlock, **Operator Instruction Manual**, pp. 2-3.
2. Prepare a list of tools needed to level kettle.
3. Discuss job performance requirements.
4. Demonstrate how to adjust jacks to insure that tank is level.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 91

CRITERION-REFERENCED MEASURE

Questions

1. Should the kettle be near or far away from the building being roofed?
2. Name two things that should not be close to kettle when setting up.
3. What should be placed under tank to protect against spillage?

Answers

1. Near
2. Flammable material and electrical wires
3. Tar paper

Practical Application

Have the students straighten kettle so that it appears level; hot tar in tank must indicate tank is level and carpenter's level must indicate kettle is level.

Method of Evaluating Practical Application

Use Checklist Performance Objective 91 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 91

LEVELING THE KETTLE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job performance requirements.		
2. Reviewed manufacturer's specifications regarding how to level the kettle.		
3. Positioned the kettle in a level area near work area.		
4. Blocked the kettle.		
5. Checked sight level of hot kerosene in tank to determine how level tank was.		
6. Adjusted jacks to raise or lower ends to bring tank to a level position; checked sight gauge; repeated the process until sight gauge approximated a level position.		
7. Laid carpenter's level on frame to determine tank was level.		
8. Adjusted jacks to fine level tank.		
9. Checked kettle for loose equipment and stable jacks and blocks.		
10. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 91

LEVELING THE KETTLE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 92

TASK

Load bitumen.

STANDARD OF PERFORMANCE OF TASK

Bitumen must fit access port and the kettle must not overflow.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Face shield
Gloves
Job specifications
Long handled axe
Manufacturer's specifications
Roofer's knife
Rubber boots

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 4.

TEACHING ACTIVITIES

1. Have the students read cold start loading instructions in Garlock, **Operator Instruction Manual**, p. 4.
2. Have the students read safety precautions on loading bitumen in Garlock, **Operator Instruction Manual**.
3. Explain how to chop bitumen into small chunks and why.
4. Discuss the difference between asphalt and coal tar and why they should not be mixed.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 92

CRITERION-REFERENCED MEASURE

Questions

1. What size chunks are ideal for loading kettle?
2. Is it safe to mix asphalt and cold tar?
3. At what point is it permissible to fire kettle?

Answers

1. 2" chunks
2. No, because of melting points it could cause a fire.
3. When vat is half full or tubes are covered.

Practical Application

Have the students load bitumen. Bitumen must fit access port and the kettle must not overflow.

Method of Evaluating Practical Application

Use Checklist Performance Objective 92 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 92

LOADING BITUMEN

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications regarding loading bitumen.		
3. Checked kettle temperature, pressures and access lid.		
4. Opened access lid and observed level of bitumen in the tank.		
5. Chopped cold solid bitumen into pieces; sizes of bitumen will vary with the access port and level of bitumen in kettle. CAUTION: USE CAUTION AND PROTECTIVE CLOTHING WHEN USING HOT BITUMEN.		
6. Fed bitumen into kettle. CAUTION: USE CARE TO AVOID SPLASHING OF HOT TAR. DO NOT OVERFILL THE KETTLE. USE CARE IN FEEDING LARGE PIECES OF BITUMEN.		
7. Observed bitumen level in kettle.		
8. Closed lid.		
9. Stockpiled chopped bitumen.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 92

LOADING BITUMEN

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Stored the axe.		
11. Monitored kettle.		
12. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 93

TASK

Keep kettle temperatures within limits.

STANDARD OF PERFORMANCE OF TASK

Temperatures must remain within specified range with a minimum of fluctuations.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Face shield
Gloves
Job specifications
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 18.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, p. 18.
2. Discuss the rule of thumb for raising temperature.
3. Prepare a handout with specifications for melting range of asphalt.
4. Prepare a list of vocabulary words for temperature control.
5. Match vocabulary words with correct definitions.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 93

CRITERION-REFERENCED MEASURE

Questions

1. What is the flash point?
2. When does asphalt begin to crack?
3. What is the rule of thumb for raising temperature?

Answers

1. The temperature at which bitumen will ignite.
2. 200° Farenheit for each pound.
3. Raise temperature in 50° increments.

Practical Application

Have the students keep kettle temperatures within limits; temperatures must remain within specified range with a minimum of fluctuations.

Method of Evaluating Practical Application

Use Checklist Performance Objective 93 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 93

KEEPING KETTLE TEMPERATURES WITHIN LIMITS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications for instructions on maintaining specified temperatures.		
3. Determined temperature specifications.		
4. Checked kettle gauges for operations and indications.		
5. Adjusted fuel feed valve clockwise to raise temperatures, counterclockwise to lower temperatures.		
6. Checked gauges.		
7. Repeated items 5 and 6 until temperatures reached and stabilized in desired range. NOTE: There will be a lag time between fuel adjustment and temperature reaction; allow sufficient time for temperature to stabilize after each fuel adjustment.		
8. Monitored temperatures.		
9. Made adjustments.		
10. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 94

TASK

Perform operator check.

STANDARD OF PERFORMANCE OF TASK

Checklist must be completed in sequence and kettle must fire properly.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Adjustable wrench
Channel lock pliers
Face shield
Gloves
Job specifications
Manufacturer's specifications

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 2.

TEACHING ACTIVITIES

1. Students read and discuss Garlock, **Operator Instruction Manual**, p. 2.
2. Prepare and distribute a list of safety requirements for pre-firing a kettle.
3. Prepare and review a worksite checklist.
4. Practice making visual inspections of the kettle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 94

CRITERION-REFERENCED MEASURE

Questions

1. Is protective clothing necessary while operating a kettle?
2. What should you look for inside the kettle before firing?
3. Four items to look for while inspecting the kettle are ________, ________, ________, and ________.

Answers

1. Yes, such as safety glasses, hard hat, long sleeves and pants without cuffs
2. Water or foreign matter
3. Worn, broken, loose parts and cracks

Practical Application

Have the students perform an operator check. Checklist must be completed in sequence and kettle must fire properly.

Method of Evaluating Practical Application

Use Checklist Performance Objective 94 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 94

PERFORMING OPERATOR CHECK

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications regarding use of checklist.		
3. Checked that the kettle was level.		
4. Visibly checked the exterior of the kettle for abnormalities.		
5. Checked all connectors for tightness and leak indications.		
6. Checked that the drawcock was closed.		
7. Checked the pump, connectors and lubrication.		
8. Checked the oil quantity.		
9. Checked the fuel quantity.		
10. Checked that flues were open.		
11. Reviewed checklist items.		
12. Rechecked items.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY OPERATING TANKERS, KETTLES

PERFORMANCE OBJECTIVE 95

TASK

Pump hot bitumen.

STANDARD OF PERFORMANCE OF TASK

Bitumen must flow unimpeded and be controllable.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Face shield
Gloves
Job specifications
Manufacturer's specifications
Pipe wrench

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Garlock. **Operator Instruction Manual**, p. 6.

TEACHING ACTIVITIES

1. Have the students read and discuss Garlock, **Operator Instruction Manual**, p. 6.
2. Demonstrate procedure to follow when setting up tubing before pumping. (Refer to Blackwell Instruction Manual, pages 1 and 2.)
3. Discuss why it is necessary to use proper oil in engine.
4. Discuss procedure for proper level of bitumen in kettle and what is done if level goes below flues.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 95

CRITERION-REFERENCED MEASURE

Questions

1. When pumping bitumen from the gound to the roof, what device is used to assist in operating the pump?
2. When first starting the pumping operation it is best to start in ________.
3. What type of oil is recommended for prolonged engine life of pump?

Answers

1. A rope
2. Stages
3. SF 20 to SE 30

Practical Application

Have the students pump hot bitumen so that it flows unimpeded and is controllable.

Method of Evaluating Practical Application

Use Checklist Performance Objective 95 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 95

PUMPING HOT BITUMEN

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications. CAUTION: USE CAUTION AND PROTECTIVE CLOTHING WHEN USING HOT BITUMEN.		
3. Started kiln engine.		
4. Opened valve on the pump; turned in the direction indicated until the valve handle seated. CAUTION: OPEN VALVE FROM THE TOP. OPERATOR STANDS CLEAR UNTIL HOT BITUMEN IS PUMPED.		
5. Monitored the flow of the hot bitumen; insured hot bitumen was flowing.		
6. Made adjustments.		
7. Used correct shut-down procedure.		
8. Cleaned work area.		
9. Cleaned tools and equipment.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

REPAIRING ROOFS

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 96

TASK

Apply plastic cement to an old valley.

STANDARD OF PERFORMANCE OF TASK

Cement must be confined to valley area and be uniformly spread; valley must not leak.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 69-71.

CONDITIONS FOR PERFORMANCE OF TASK

Bucket
Claw hammer
Manufacturer's specifications
Pry bar
Putty knife
Roofer's knife
Foldout rule or tape measure
Hand scraper
Job specifications
Plastic cement
Push broom
Roller
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Read and discuss **Teacher Information Sheet**.
2. Demonstrate proper method for raising shingles along the edge of a valley.
3. Explain formula for calculating roof cement coverage.
4. Discuss reasons necessary to apply new cement to old valley.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 96

CRITERION-REFERENCED MEASURE

Questions

1. Name the term used to describe shrinking or cracking of roofing exposed to weather.
2. What amount of roofing cement is needed to cover 100 sq. ft. of roofing surface?
3. What tool is used to raise shingles along the edge of valley?

Answers

1. Alligator
2. 3 gal.
3. Pry bar

Practical Application

Have the students apply plastic cement to an old valley so that cement will be confined to valley area and be uniformly spread; valley will not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 96 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 96

APPLYING PLASTIC CEMENT TO AN OLD VALLEY

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Reviewed manufacturer's specifications regarding the application of plastic cement.		
3. Inspected and prepared valley to be cemented.		
4. Determined the amount of plastic cement needed for application to valley.		
5. Scraped the valley free of cement and debris; broomed, washed down and wiped valley, and allowed valley time to dry.		
6. Dubbed corners of shingles near valley if they were raised or overlapped the valley.		
7. Removed nails from dubbed shingles.		
8. Pointed nail holes with plastic cement.		
9. Applied plastic cement to the roof valley; started at the top of the valley, worked to the eaves, applied plastic cement in vertical strokes, and worked 2' sections of the valley.		
10. Repeated item 9 until valley was coated with plastic cement.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 96

APPLYING PLASTIC CEMENT TO AN OLD VALLEY

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Checked the valley for complete coverage, uniformity of application, and insured nail holes were covered.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature   Date

TEACHER INFORMATION SHEET
(Performance Objective 96)

At some point in time it will be necessary to apply plastic roofing cement to an old valley. One reason is that cracks or leaks develop and require maintenance.

One of the signs to look for is alligatoring. This is caused by a shrinkage of the bituminous surface. When this occurs a repair is necessary.

First, clean the surface of all debris and sweep completely.

Second, loosen all shingles along the edges of the valley with a pry bar so that each shingle can be raised to allow roofing cement to be spread under it (note: care should be taken to not damage shingles.)

Third, measure the area to be covered so that the required amount of roofing cement may be calculated. (note: 1 gallon will cover 33 square feet.)

Fourth, use a putty knife of medium size to apply cement. Begin at the ridge and apply vertically to the eave using uniform strokes, making sure of complete coverage and leaving no void.

Last, take care as to not spread or track cement onto other parts of the roof.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 97

TASK

Eliminate leak along seam/edge of overlapping felt.

STANDARD OF PERFORMANCE OF TASK

Seam/edge must not leak; repaired section must conform to the contour of the roof.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 69-71.
U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 7.

CONDITIONS FOR PERFORMANCE OF TASK

Bonding agent
Job specifications
Mop
Mop cart
Roofer's knife
Folding rule

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Koppers. **Koppers Roof Repair Manual**, pp. 6-7.

TEACHING ACTIVITIES

1. Have the students read and discuss **Koppers Roof Repair Manual**, pp. 6-7.
2. Explain how to search under side of roof to find leak.
3. Discuss what to look for when making search.
4. Prepare and distribute a list of causes for leaks that may occur along seam edge.
5. Demonstrate formula for applying roof resaturant to leaking area.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 97

CRITERION-REFERENCED MEASURE

Questions

1. Name three things that may cause a leak along the seam or edge.
2. What should you search for under the roof to identify a leak?
3. Give the formula for applying roof resaturant.

Answers

1. Foot traffic, nails backing out, or dropped objects
2. Water marks on underside of roof insulation.
3. 7 gallons per 100 square feet.

Practical Application

Have the students eliminate a leak along seam/edge of overlapping felt so that seam/edge does not leak, and repaired section conforms to the contour of the roof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 97 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 97

ELIMINATING A LEAK ALONG SEAM/EDGE OF OVERLAPPING FELT

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared work area.		
3. Located the leak area by noting discoloration, dripping water, or leak marker.		
4. Removed gravel from top of felt.		
5. Cut through felt in the immediate area of leak and determined extent to which leak had affected the insulation.		
6. Determined the extent of water damage to the felt.		
7. Removed water damaged felt; insured sufficient felt was removed to eliminate the water damage.		
8. Squared up edges of felt by trimming.		
9. Measured the area removed.		
10. Cut felt patch to match water damaged felt that was removed.		
11. Positioned and trimmed patch to fit; taped along seams to insure snug fit.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 97

ELIMINATING A LEAK ALONG SEAM/EDGE OF OVERLAPPING FELT

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Inspected patched area for conformity, wrinkles and voids.		
13. Solidly mopped patched area with bonding agent.		
14. Replaced gravel over patched area.		
15. Checked patched area for conformity to the roof.		
16. Made adjustments.		
17. Cleaned work area.		
18. Cleaned tools and equipment.		
19. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature

Date

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 98

TASK

Install tin shingle to wood roof.

STANDARD OF PERFORMANCE OF TASK

Tin shingle must match the contour of roof; exposed corners of the tin shingle must be bent approximately 45° downward.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside**, pp. 9-10.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Job specifications
Keyhole saw
Pliers
Tin snips
Folding rule

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students read and discuss the **Teacher Information Sheet**.
2. Discuss what to look for when this task is to be performed.
3. Practice cutting tin with snips.
4. Practice bending metal to a 45° angle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 98

CRITERION-REFERENCED MEASURE

Questions

1. What tool should be used to cut galvanized metal?
2. To what angle should the bottom of the tin be bent?
3. What is the purpose for bending the metal?

Answers

1. Tin snips
2. 45°
3. So it can be pressed into the shingle and will not have to be nailed.

Practical Application

Have the students install tin shingle to wood roof so that the shingle matches the contour of roof, and corners bend 45° downward.

Method of Evaluating Practical Application

Use Checklist Performance Objective 98 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 98

INSTALLING TIN SHINGLE TO WOOD ROOF

Student's Name **Date**

DIRECTIONS TO STUDENT	Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.
DIRECTIONS TO EVALUATOR	Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Isolated leak area, split shingles or defective joint.		
3. Inspected and prepared work area by removing debris from leak area.		
4. Measured leak area to determine size of shingle required.		
5. Slid tin shingle underneath split, crack or defective joint; tapped bottom edge of shingle to drive it firmly and as far as possible under wood shingles.		
6. Bent the exposed corners of the shingle at least 45° downward so the sharp corners penetrated the wood shingles and prevented the tin shingle from slipping out; did not nail the tin shingle in place as nails would eventually work their way out.		
7. Checked work area for contour and positioning of the shingle.		
8. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 98

INSTALLING TIN SHINGLE TO WOOD ROOF

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature　Date

TEACHER INFORMATION SHEET
(PERFORMANCE OBJECTIVE 98)

When a split occurs in a wood shingle, it may be necessary to patch the split by installing a tin shingle under the split. This could also be called "flashing the split".

To perform this task cut a piece of galvanized tin to correct size of area to be repaired. Slide the metal under the split shingle until it is above the area to be patched, then tap gently to make sure it is as far as it will go. Bend the bottom edges so they will press in the lower shingle and keep metal in place. Do not nail the metal, as nails will work themselves out over a period of time and cause a leaking problem.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 99

TASK

Isolate leak in roof.

STANDARD OF PERFORMANCE OF TASK

Leak area must be located and confined.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Job requirements
Chalk
Flashlight
Garden hose
Job requirements
Measuring tape
Pads
Pencil
Pry bar
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurements of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Bird and Son. **Residential Asphalt Roofing Manual**, p. 56.

TEACHING ACTIVITIES

1. Have the students read and discuss Bird and Son, **Residential Asphalt Roofing Manual**, p. 56.
2. Discuss the best time to search for leaks.
3. Discuss what to look for when isolating the leak.
4. Demonstrate how to locate and confine a leak.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 99

CRITERION-REFERENCED MEASURE

Questions

1. What item is needed to usually isolate a leak inside the roof?
2. What should you look for to isolate the leak?
3. When is the best time to inspect the roof for leaks and why?

Answers

1. Flashlight
2. Water stains, trails, and dirt stains.
3. Spring or after a heavy rain because that is when leaking is likely to occur.

Practical Application

Have the students isolate leak in roof so that leak area will be confined.

Method of Evaluating Practical Application

Use Checklist Performance Objective 99 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 99

ISOLATING LEAK IN ROOF

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job requirements.		
2. Inspected general area of leak.		
3. Looked for evidence of leak: water spots, trails, or dirt stains.		
4. Located potential leak area.		
5. Measured location of leak area from underneath the roof area; made several measurements from points which were measured on the roof.		
6. Made similar measurements from distinguishable points on top of the roof.		
7. Marked leak area with chalk.		
8. Inspected area, pried up shingles, and determined cause of the leak.		
9. Ran water over area to confirm the area.		
10. Located the leak by marking with chalk.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 100

TASK

Patch a blister.

STANDARD OF PERFORMANCE OF TASK

Blister must be removed; patch must conform to contour of roof and must not leak.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside,** p. 7.
Readers' Diogest Association. **Complete Do-It-Yourself Manual,** p. 168.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Fold out rule
Galvanized fasteners
Job specifications
Sheet of asphalt roofing felt
Paint brush
Putty knife
Roofing cement
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.

RESOURCE

Koppers Roof Repair Manual, p. 6.

TEACHING ACTIVITIES

1. Have the students read and discuss **Koppers Roof Repair Manual,** p. 6.
2. Define blister and explain its causes.
3. Describe what long range dangers may occur if blisters are not repaired.
4. Prepare and distribute handout with a drawing of a blister.
5. Demonstrate how to cut felt that is elevated so that area may dry out.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 100

CRITERION-REFERENCED MEASURE

Questions

1. What is a blister and what causes this condition?
2. Is the blister something that requires immediate action?
3. What type of cut is made in felt when patching a blister?

Answers

1. Air bubble caused by moisture between layers of felt.
2. No, unless there is heavy traffic or exposure to elements.
3. An X is cut and exposed to dry.

Practical Application

Have the students patch a blister. Patch should conform to contour of roof and not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 100 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 100

PATCHING A BLISTER

Student's Name ________________________________ **Date** ____________

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected work area for size and type of blister.		
3. Cut the blister by inserting knife point into one edge and cutting the blister lengthwise.		
4. Cleaned out the area in and around blister.		
5. Placed roofing cement into blister area.		
6. Used an applicator; placed a thin layer of roofing cement over cut blister area, covering the area with an overlap of about 2".		
7. Measured area around the blister.		
8. Cut a piece of felt at least 2" larger than work area; positioned it over the blister and pressed firmly into place.		
9. Nailed edges of the felt patch, spacing the nails 1" apart.		
10. Spread another layer of roofing cement over the felt piece; extended the roofing cement 2" beyond the edge of the patch.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 100

PATCHING A BLISTER

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Inspected the work area for voids or humps.		
12. Made adjustments.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 101

TASK

Remove a ridge shingle.

STANDARD OF PERFORMANCE OF TASK

Shingle must be removed with no damage to deck or surrounding shingles; shingle must be aligned with other ridge shingles.

SOURCE OF STANDARD

Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 166.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Fold out rule
Galvanized fasteners
Hacksaw blade
Job specifications
Pry bar
Putty knife
Roofing cement
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students read and discuss **Teacher Information Sheet**.
2. Demonstrate proper procedure to remove ridge shingle.
3. Practice cutting nail heads off without damaging shingles.
4. Demonstrate proper method to cut ridge shingle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 101

CRITERION-REFERENCED MEASURE

Questions

1. What tool is needed to break the seal of overlaying ridge shingle?
2. Name the tools needed to remove nails from a ridge shingle.
3. What is used to assure that leaks will not occur?

Answers

1. Putty knife
2. Pry bar, hammer, and hack saw
3. Roofing cement

Practical Application

Have the students remove ridge shingle so there will be no damage to deck or surrounding shingles, and shingle will be aligned with other ridge shingles.

Method of Evaluating Practical Application

Use Checklist Performance Objective 101 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 101

REMOVING RIDGE SHINGLE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	**RATING**	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Located damaged shingle and inspected area.		
3. Raised ridge shingle overlapping the damaged shingle and removed nails. NOTE: If nails cannot be removed, cut them off with a hacksaw.		
4. Removed damaged shingle and cleaned area.		
5. Selected shingle to replace damaged one; dubbed to fit.		
6. Positioned and secured shingle in place.		
7. Pointed up nail heads with roof cement. NOTE: Insure nails are covered by upper shingles when they are lowered in place.		
8. Checked work area for damage, alignment, and security.		
9. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 101

REMOVING RIDGE SHINGLE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

TEACHER INFORMATION SHEET
(PERFORMANCE OBJECTIVE 101)

When a ridge shingle becomes damaged and must be replaced, carefully break the seal of the overlaying ridge shingle using a putty knife. The nails should be removed without causing damage to surrounding shingles or ridge; if this is not possible, use a hacksaw and cut the head of nail off. Remove ridge shingle. New ridge shingle is ready to install. Cover old nail holes with roofing cement; dub ridge shingle to fit; put into place; nail properly.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 102

TASK

Replace an asphalt/fiberglass shingle.

STANDARD OF PERFORMANCE OF TASK

Shingle must not be damaged and must be securely positioned and aligned with surrounding shingles.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 10.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 168.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Fold out rule
Galvanized fasteners
Hacksaw blade
Job specifications
Pry bar
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students read and discuss **Teacher Information Sheet**.
2. Demonstrate proper way to break seal of shingle.
3. Demonstrate proper way to remove nails from shingle.
4. Discuss why it is necessary to match shingle color dye lot.
5. Plan and organize a field trip to local building supply to see various roofing colors.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 102

CRITERION-REFERENCED MEASURE

Questions

1. Why is it necessary to break seal of surrounding shingles?
2. Why should nails be removed from overlaying shingle?
3. Why is it important to match shingle color?

Answers

1. So that other shingles will not be destroyed.
2. They also penetrate shingle below.
3. Appearance

Practical Application

Have the students replace an asphalt/fiberglass shingle. Shingle must not be damaged; it must be securely positioned and aligned with surrounding shingles.

Method of Evaluating Practical Application

Use Checklist Performance Objective 102 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 102

REPLACING AN ASPHALT/FIBERGLASS SHINGLE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located the shingle to be replaced and inspected area.		
3. Raised the shingle which overlapped the damaged shingle to expose nails; removed nails. NOTE: If nails cannot be removed, cut them off with a hacksaw blade.		
4. Removed damaged shingle and cleaned the area.		
5. Selected shingle to replace damaged one; dubbed shingle to fit.		
6. Positioned and secured shingle in place.		
7. Pointed up nail heads with roof cement. NOTE: Insure nails are covered by upper shingles when they are lowered in place.		
8. Checked work area for damage, alignment, and security.		
9. Made adjustments.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 102

REPLACING AN ASPHALT/FIBERGLASS SHINGLE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Cleaned work area.		
11. Cleaned tools and equipment.		
12. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

TEACHER INFORMATION SHEET
(PERFORMANCE OBJECTIVE 102)

When a shingle becomes damaged and it is necessary to replace it, the following steps should be taken:

1. Break seal of shingles around the damaged shingle using a pry bar or putty knife. This is done by sliding the tool gently under the shingle and raising the edges. Care should be taken not to damage surrounding shingles.
2. Remove nails from overlaying shingle and damaged shingle (Note: Reason for this is the overlaying shingle nails also penetrate next shingle).
3. Select a shingle that will closely match existing shingles in color, and measure to see if it will fit opening; if not, trim with snips.
4. Use putty knife and apply roofing cement to waterproof over old nail holes.
5. Place new shingle into position and fasten with correct nailing procedure.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 103

TASK

Replace shingle (wood shake).

STANDARD OF PERFORMANCE OF TASK

Shingle must not be damaged; they must be aligned with surrounding shingles.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside,** p. 9.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Fold out rule
Galvanized fasteners
Hacksaw blade
Job specifications
Keyhole saw
Pry bar
Putty knife
Roof cement
Roofer's knife
Roofing hatchet
Screwdriver
Wood chisel

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students read and discuss the **Teacher Information Sheet**.
2. Demonstrate proper way to remove old shingle.
3. Have the students prepare a list of tools needed to perform task.
4. Have the students practice cutting wood shingles to fit an opening.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 103

CRITERION-REFERENCED MEASURE

Questions

1. What tool is used to cut old shingles for removal?
2. What is used to drive new shingle into position so that the shingle is not damaged?
3. What is used to waterproof nail heads?

Answers

1. Wood chisel
2. Block of wood
3. Roofing cement

Practical Application

Have the students replace wood shingle or shake. Shingle must not be damaged and must be aligned with surrounding shingles.

Method of Evaluating Practical Application

Use Checklist Performance Objective 103 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 103

REPLACING SHINGLE (WOOD SHAKE)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located shingle to be replaced; examined it and surrounding area.		
3. Cut shingle lengthwise with a chisel or screwdriver so it could be easily removed.		
4. Pried up shingles above damaged one to expose nails; pried out nails. CAUTION: DO NOT CRACK THE SHINGLE WHILE PRYING IT UP.		
5. Cleaned area under removed shingle.		
6. Measured space where the shingle was removed; cut a replacement shingle to fit.		
7. Positioned shingle in place; trimmed to fit; drove replacement shingle upward underneath the top shingle. NOTE: Use a block of wood placed along the edge of the shingle and a hammer to drive the shingle in place.		
8. Fastened shingle to deck.		
9. Pointed-up nail heads with roof cement.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 103

REPLACING SHINGLE (WOOD SHAKE)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located shingle to be replaced; examined it and surrounding area.		
3. Cut shingle lengthwise with a chisel or screwdriver so it could be easily removed.		
4. Pried up shingles above damaged one to expose nails; pried out nails. CAUTION: DO NOT CRACK THE SHINGLE WHILE PRYING IT UP.		
5. Cleaned area under removed shingle.		
6. Measured space where the shingle was removed; cut a replacement shingle to fit.		
7. Positioned shingle in place; trimmed to fit; drove replacement shingle upward underneath the top shingle. NOTE: Use a block of wood placed along the edge of the shingle and a hammer to drive the shingle in place.		
8. Fastened shingle to deck.		
9. Pointed-up nail heads with roof cement.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 103

REPLACING SHINGLE (WOOD SHAKE)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Inspected area for alignment damage and fit.		
11. Made adjustments.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature Date

TEACHER INFORMATION SHEET
(PERFORMANCE OBJECTIVE 103)

When a wood shingle becomes damaged and must be replaced, take care not to damage surrounding shingles. Use a wood chisel to split the shingle so that it will slide away from nails in overlaying shingle. Remove nails; cut new shingle to fit opening; waterproof old nail holes; place new shingle into position, and tap at bottom to drive upward and align with other shingles; fasten with nails.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 104

TASK

Replace a valley with rolled roofing.

STANDARD OF PERFORMANCE OF TASK

Replaced valley must be free from wrinkles, voids or tears.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Fold out rule
Galvanized fasteners
Job specifications
Measuring tape
Plastic cement
Plastic cement applicator
Push broom
Roofer's knife

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Teacher Information Sheet

TEACHING ACTIVITIES

1. Have the students read and discuss the **Teacher Information Sheet**.
2. Demonstrate the proper way to remove shingles from roof without damage.
3. Demonstrate how to measure valley for cutting new material.
4. Demonstrate how to apply roofing cement along valley edge.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 104

CRITERION-REFERENCED MEASURE

Questions

1. What is the recommended width of the roll roofing used for the valley?
2. What thickness of roofing cement should be applied to the edges of the old valley?
3. How many people will be needed to apply roll roofing to the valley?

Answers

1. 18"
2. 1/4"
3. 2

Practical Application

Have the students replace a valley with rolled roofing so that it is free of wrinkles, voids or tears.

Method of Evaluating Practical Application

Use Checklist Performance Objective 104 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 104

REPLACING VALLEY WITH ROLLED ROOFING

Student's Name Date

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared valley.		
3. Removed all nails on both sides of valley, leaving center nails intact.		
4. Layed loose shingles out of way.		
5. Measured length and width of valley.		
6. Cut an 18" strip of 90 pound roll roofing the length of the valley.		
7. Rechecked sides of valley to insure side shingles could be raised and that nails on sides of valley had been removed.		
8. Applied plastic cement to the old valley; applying uniformly about 1/4" thick, covering valley from top to bottom, and from one edge of the shingles to the other.		
9. At bottom of the valley, slid the 18" strip of shingle into place; pulled strip up into position to top of the valley. NOTE: This sliding operation will require two people; one to pull the strip upward, the other to feed the material from the bottom.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 104

REPLACING VALLEY WITH ROLLED ROOFING

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Positioned material; pressed into cement by walking down and brooming.		
11. Replaced and renailed shingles that were moved or removed. NOTE: Be sure to replace all nails which were removed.		
12. Checked work area for trim, wrinkles, voids or tears.		
13. Made adjustments.		
14. Cleaned work area.		
15. Cleaned tools and equipment.		
16. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature

Date

TEACHER INFORMATION SHEET
(PERFORMANCE OBJECTIVE 104)

Replacing a valley is a major job and should be finished before bad weather interferes with the job.

Remove shingles along each side of valley to be repaired; care should be used so as not to damage shingles since they will be used for installation of new valley. After shingles are removed, inspect decking to see if any structural damage has occurred; if not, measure valley and cut roll roofing to fit valley. Apply roofing cement along edges of valley and place new roll roofing into cement; replace old shingles.

This job will require a helper so that new roll roofing can be installed properly.

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 105

TASK

Tighten loose felt edges.

STANDARD OF PERFORMANCE OF TASK

Felt must be taut, with no tears or rips.

SOURCE OF STANDARD

State of Georgia Writing Team

CONDITIONS FOR PERFORMANCE OF TASK

Brush, soft bristle
Claw hammer
Galvanized fasteners
Job specifications
Putty knife
Roof cement
Upright broom

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Readers Digest. **Do It Yourself Manual**, p. 168.

TEACHING ACTIVITIES

1. Have the students read and discuss Readers Digest, **Do It Yourself Manual**, p. 168.
2. Demonstrate how to lift and clean around and under loose felt.
3. Demonstrate the nailing procedure for spacing and direction.
4. Demonstrate procedure for applying roofing cement.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 105

CRITERION-REFERENCED MEASURE

Questions

1. A shovel is an appropriate tool for cleaning the felt. True or False?
2. The nail spacing for replacing loosened felt is approximately ________.
3. How far beyond the nailed area should the roofing cement be applied?

Answers

1. False
2. 1"
3. 2"

Practical Application

Have the students tighten loose felt edges. Felt must be taut, with no tears or rips.

Method of Evaluating Practical Application

Use Checklist Performance Objective 105 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 105

TIGHTENING LOOSE FELT EDGES

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Inspected and prepared the work area.		
3. Gently lifted the loose edges of the felt and cleaned the area underneath felt.		
4. Positioned felt back to deck and pressed into place.		
5. Nailed felt into place, spacing nails approximately 1" apart; nailed from the side of the loose area toward edge.		
6. Covered the nailed area with roofing cement; applied cement approximately 2" beyond the nailed area.		
7. Checked work area for damage and tautness.		
8. Made adjustments.		
9. Cleaned work area.		
10. Cleaned tools and equipment.		
11. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 106

TASK

Waterproof a split in a BUR (Built-up roof).

STANDARD OF PERFORMANCE OF TASK

Waterproof split must conform to the contour of the roof.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 5.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 168.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fasteners
Job specifications
Paint brush
Putty knife
Roofer's knife
Roofing cement
Sheet of asphalt roofing felt

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Recall measurement of length using a rule or tape.
4. Demonstrate safe work practices.

RESOURCE

Koppers Roof Repair Manual, p. 4.

TEACHING ACTIVITIES

1. Have the students read and discuss **Koppers Roof Repair Manual**, p. 4.
2. Discuss what causes a split to occur in the BUR.
3. Explain the danger created by a split.
4. Demonstrate the procedure for cleaning and spudding around a split.
5. Demonstrate the proper method of cutting the end of a split.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 106

CRITERION-REFERENCED MEASURE

Questions

1. What causes a tension split?
2. An area of __________ on each side of split should be spudded and cleaned.
3. Name the cut used at each end of the split to help reduce the spreading.

Answers

1. Loss of volatile oil
2. 12"
3. "T" cut

Practical Application

Have the students waterproof a split in BUR so that it conforms to the contour of the roof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 106 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 106

WATERPROOFING A SPLIT IN BUR

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located and inspected roof split area.		
3. Prepared split for repairs, trimmed ragged edges and cleaned dirt and debris.		
4. Placed thin layer of cement over split; spread cement over cleaned area surrounding the split.		
5. Measured area around split.		
6. Cut a piece of felt at least 2" larger than work area positioned it over the split and pressed firmly into place.		
7. Nailed edges of the patch; spaced nails at least 1" apart.		
8. Spread another layer of roofing cement over the felt piece; extended the roofing cement at least 2" beyond the edge of the patch.		
9. Checked the work area for voids or humps.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 106

WATERPROOFING A SPLIT IN BUR

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
10. Made adjustments.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES ____ NO ____

Evaluator's Signature Date

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 107

TASK

Waterproof chimney flue cracks.

STANDARD OF PERFORMANCE OF TASK

Cracks will be free of all debris, filled with sealant, and must be waterproof.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside,** p. 13.
Readers' Digest Association. **Complete Do-It-Yourself Manual,** pp. 175-177.

CONDITIONS FOR PERFORMANCE OF TASK

Brush, hard bristle
Butyl type caulking compound
Caulking gun
Claw hammer
Cold chisel
Job specifications
Putty knife
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Readers Digest. **Complete Do-It-Yourself Manual**, p. 462.

TEACHING ACTIVITIES

1. Have the students read and discuss Readers Digest, **Complete Do-It-Yourself Manual**, p. 462.
2. Explain precautions taken to clean flue cracks.
3. Demonstrate the proper method of caulking flue cracks.
4. Demonstrate the method of smoothing out caulking compound.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 107

CRITERION-REFERENCED MEASURE

Questions

1. Before cleaning the flue cracks, what should be closed to stop debris from falling into the house?
2. To which direction should caulk be applied to the flue crack?
3. What should be used to smooth out the caulk?

Answers

1. Damper
2. From the top down
3. A damp cloth

Practical Application

Have the students waterproof chimney flue cracks so that cracks will be free of all debris, filled with sealant, and waterproof.

Method of Evaluating Practical Application

Use Checklist Performance Objective 107 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 107

WATERPROOFING CHIMNEY FLUE CRACKS

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located and inspected cracked area.		
3. Cleaned the crack with a brush to remove all debris; chipped edges to facilitate sealer application.		
4. Started from top of crack and worked downward applying caulking compound between flue and chimney mortar cap; filled crack until caulking compound was even with sides of the crack.		
5. Dampened a cloth and smoothed out caulking compound.		
6. Checked work area for voids.		
7. Made adjustments.		
8. Cleaned work area.		
9. Cleaned tools and equipment.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature **Date**

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 108

TASK

Waterproof an asphalt/fiberglass shingle.

STANDARD OF PERFORMANCE OF TASK

Shingle must be bonded to the deck and must not leak.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 10.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Galvanized fastener
Hose
Job specifications
Putty knife
Roofer's knife
Roofing cement
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Time Life Books. **Complete Home Repair Manual**, pp. 264, 394.

TEACHING ACTIVITIES

1. Have the students read and discuss **Complete Home Repair Manual**, pp. 264, 394.
2. Demonstrate the proper method to lift a shingle without causing further damage.
3. Explain all do's and don'ts of waterproofing a shingle.
4. Have the students refer to **Complete Home Repair Manual**, p. 264, for proper use of caulking gun.
5. Demonstrate how to repair and waterproof a small tear in shingle.
6. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 108

CRITERION-REFERENCED MEASURE

Questions

1. Weather will play an important part in waterproofing the shingle. True or False?
2. How is it determined if a shingle can be repaired or must be replaced?
3. What should be used to waterproof the shingle?

Answers

1. True
2. If the damage does not extend under the overlapping shingle, it can be repaired.
3. Roofing cement or quick setting shingle cement

Practical Application

Have the students waterproof an asphalt/fiberglass shingle so that shingle will be bonded to the deck and not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 108 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 108

WATERPROOFING ASPHALT/FIBERGLASS SHINGLE

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specification.		
2. Located, inspected and prepared shingle for waterproofing.		
3. Lifted shingle to be waterproofed; cleaned dirt and debris from underneath. CAUTION: LIFTING THE SHINGLE TOO HIGH CAN CAUSE NAILS TO TEAR AWAY FROM SHINGLE, CAUSING FURTHER DAMAGE.		
4. Applied ample amount of roofing cement underneath the shingle.		
5. Pressed shingle firmly into place; nailed it down.		
6. Pointed up nail heads with cement.		
7. Inspected work area for rips or voids.		
8. Made adjustments.		
9. Allowed repaired area sufficient time to dry.		
10. Tested for leaks.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 108

WATERPROOFING ASPHALT/FIBERGLASS SHINGLE

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
11. Made adjustments.		
12. Cleaned work area.		
13. Cleaned tools and equipment.		
14. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature Date

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 109

TASK

Waterproof loose mortar joints.

STANDARD OF PERFORMANCE OF TASK

Mortar joints must not contain voids and must not leak; joints must be free of debris and excess caulk.

SOURCE OF STANDARD

U.S Department of Agriculture. **Simple Home Repairs...Outside**, p. 11.

CONDITIONS FOR PERFORMANCE OF TASK

Butyl caulking compound (rope form)
Caulk gun
Cold chisel
Hammer
Job specifications
Putty knife
Trowel
Wire brush

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Time Life Books. **Complete Home Repair Manual**, p. 417.

TEACHING ACTIVITIES

1. Have the students read and discuss Time Life Books, **Complete Home Repair Manual**, p. 417.
2. Demonstrate proper way to chip and remove debris from mortar joint.
3. Demonstrate proper way to force caulk into joints.
4. Have students prepare a list of tools required to complete the task.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 109

CRITERION-REFERENCED MEASURE

Questions

1. Safety glasses should be worn when chipping away loose mortar. True or False?
2. What is forced into joints to waterproof?
3. What tools are used to force waterproofing into mortar joint?

Answers

1. True
2. Butyl caulk (rope form)
3. Trowel or putty knife

Practical Application

Have the students waterproof loose mortar joints so that joints contain no voids, do not leak, and are free of debris and excess caulk.

Method of Evaluating Practical Application

Use Checklist Performance Objective 109 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 109

WATERPROOFING LOOSE MORTAR JOINTS

Student's Name ______________________ Date ______________

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
1. Reviewed job specifications.		
2. Located loose mortar joints.		
3. Chipped out the loose mortar from the joint.		
4. Brushed down the mortar joint to clean out dust and debris.		
5. Wiped area clean.		
6. Unwound length of caulking compound and forced it into the joints.		
7. Cleaned away excess caulking compound.		
8. Continued items 6 and 7 until entire joint was caulked.		
9. Checked area for excess caulk, voids, and gaps.		
10. Made adjustments.		
11. Cleaned work area.		
12. Cleaned tools and equipment.		
13. Performed all work in a safe manner.		

APPROVED: YES _____ NO _____

Evaluator's Signature ______________________ Date ______________

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 110

TASK

Waterproof plumbing vent.

STANDARD OF PERFORMANCE OF TASK

Vent must be free of excess caulking compound and must not leak.

SOURCE OF STANDARD

Johnson. **Roofer's Handbook**, pp. 106-109.
U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 14.
Readers' Digest Association. **Complete Do-It-Yourself Manual**, p. 175.

CONDITIONS FOR PERFORMANCE OF TASK

Aluminized caulking compound
Claw hammer
Galvanized fasteners
Job specifications
Putty knife
Roofing cement
Wiping rags

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Time Life Books. **Complete Home Repair Manual**, pp.395, 403.

TEACHING ACTIVITIES:

1. Have the students read and discuss Time Life Books, **Complete Home Repair Manual**, pp. 395, 403.
2. Demonstrate steps to waterproof vent pipe.
3. Have the students prepare a list of tools needed to waterproof a vent.
4. Have the students refer to page 395, Time Life Books, **Complete Home Repair Manual**, for removal of shingle.
5. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 110

CRITERION-REFERENCED MEASURE

Questions

1. What type of caulking is best used for waterproofing the vent?
2. What is the first step in waterproofing the vent?
3. What must be done if old flashing is stuck to roof?

Answers

1. Aluminized caulking compound
2. Remove shingle to expose all of vent
3. Cut away and replace with new felt

Practical Application

Have the students waterproof plumbing vent so that vent does not leak and is free of excess caulking compound.

Method of Evaluating Practical Application

Use Checklist Performance Objective 110 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 110

WATERPROOFING PLUMBING VENT

Student's Name **Date**

DIRECTIONS TO STUDENT — Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR — Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Located and examined plumbing vent.		
3. Prepared vent by removing dust and debris. A. Waterproofed between collar and metal surface. 1. Caulked around collar with aluminized caulking compound. 2. Wiped away excess caulking. B. Waterproofed between metal shield and shingles. 1. Cleaned metal shield. 2. Renailed shielding in place. 3. Applied heavy coat of roofing cement where the shield joined shingles.		
4. Checked area for excess caulking and voids.		
5. Made adjustments.		
6. Allowed caulking and/or cement time to dry.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 110

WATERPROOFING PLUMBING VENT

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
7. Tested for and eliminated leaks.		
8. Cleaned work area.		
9. Cleaned tools and equipment.		
10. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

DUTY REPAIRING ROOFS

PERFORMANCE OBJECTIVE 111

TASK

Waterproof shingle cracks (wood shakes).

STANDARD OF PERFORMANCE OF TASK

Shingles must be free of damage and must not leak.

SOURCE OF STANDARD

U.S. Department of Agriculture. **Simple Home Repairs...Outside**, p. 9.

CONDITIONS FOR PERFORMANCE OF TASK

Claw hammer
Job specifications
Putty knife
Roof cement
Wood chisel

ENABLING OBJECTIVES

1. Read and interpret job specifications.
2. Select and use basic tools.
3. Demonstrate safe work practices.

RESOURCE

Time Life Books. **Complete Home Repair Manual**, p. 396.

TEACHING ACTIVITIES

1. Have the students read and discuss **Complete Home Repair Manual**, p. 396.
2. Demonstrate the proper way to cut metal for waterproofing a wood shingle.
3. Demonstrate proper way to install copper or aluminum flashing.
4. Have the students complete the performance of the task.

PERFORMANCE OBJECTIVE 111

CRITERION-REFERENCED MEASURE

Questions

1. What type of metal flashing is used to waterproof a wood shingle?
2. Give the dimensions for metal flashing to waterproof a shingle.
3. What is used to drive flashing into place?

Answers

1. Copper or aluminum
2. Twice as wide as shingle and 3" longer
3. Hammer and block of wood

Practical Application

Have the students waterproof shingle cracks (wood shakes) so that shingles are free of damage and do not leak.

Method of Evaluating Practical Application

Use Checklist Performance Objective 111 to determine if the assignment was completed accurately.

CHECKLIST FOR PERFORMANCE OBJECTIVE 111

WATERPROOFING SHINGLE CRACKS (WOOD SHAKES)

Student's Name **Date**

DIRECTIONS TO STUDENT Prepare the proper equipment. Follow the verbal directions given by the instructor. Complete each step in the sequential order listed.

DIRECTIONS TO EVALUATOR Observe the student. Pay close attention to items to be evaluated. Be sure the student completes the tasks within a reasonable time. A score of 100 percent is required for competency.

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	**Unsatisfactory**
1. Reviewed job specifications.		
2. Located and examined cracked shingle.		
3. Prepared crack for waterproofing. NOTE: If crack is less than 1/4", pull out loose splinters; leave the large ones intact. If the crack is over 1/4", remove all splinters.		
4. Checked roofing materials under the shingle to determine where the nails should be placed.		
5. Butted solid pieces of shingle tightly and nailed the split shingle together. CAUTION: DRIVE NAILS UNTIL HEAD IS FLUSH WITH SHINGLE; DO NOT DIMPLE.		
6. Covered the crack with roofing cement.		
7. Pointed up nail heads with cement.		
8. Removed excess cement.		
9. Checked work area for damage.		
10. Made adjustments.		
11. Allowed sufficient time for roofing cement to dry.		

CHECKLIST FOR PERFORMANCE OBJECTIVE 111

WATERPROOFING SHINGLE CRACKS (WOOD SHAKES)

ITEMS TO BE EVALUATED	RATING	
	Satisfactory	Unsatisfactory
12. Tested for and eliminated any leaks.		
13. Cleaned work area.		
14. Cleaned tools and equipment.		
15. Performed all work in a safe manner.		

APPROVED: YES _____ NO ____

Evaluator's Signature **Date**

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APPENDICES

APPENDIX A

DUTY/TASK LIST

Project Code:	1367
O.E. Code/Title:	17.1010 Roofing
D.O.T. Codes/Titles:	866.381-010 Roofer 866.381-014 Roofer Apprentice 866.131-010 Roofing Supervisor

APPENDIX A

DUTY/TASK LIST

	DUTY/TASK	**PO/Page No.**
A.	APPLYING SURFACE MATERIALS	
01	Apply adhesive.	1/7
02	(A12) Apply base sheet to a (saddle).	
03	Apply flood coating.	2/11
04	Apply roof membrane.	3/14
05	(B18) Attach drip edge.	4/17
06	Attach gravel guard.	5/20
07	Attach lead collar to vent.	6/23
08	(A09) Attach pitch pans.	7/26
09	(A08) Cut felt.	
10	(A30) Determine starting point of a built-up roof.	
11	Envelope edges. (Envelope edges of felt).	8/30
12	(A02) Lay base sheet to a cricket (saddle).	9/33
13	Lay cant strip.	10/36
14	Lay canvas.	11/40
15	(C30) Lay cricket, hogback and taper tile.	
16	Lay capsheet.	12/44
17	Lay felt over hot binder.	13/48
18	(A31) Lay insulation.	14/52
19	Lay roll roofing.	15/56
20	Lay vapor retarders.	16/60
21	Mop finishing plies to a cricket.	17/63
22	Mop rolled roofing with hot bitumen (spot, strip, solid).	18/66
23	Nail a base sheet.	19/70
24	Prime the substrate.	20/74
25	Scratch gravel.	21/78

	DUTY/TASK	PO/Page No.
A.	APPLYING SURFACE MATERIALS Continued	
26	(C16) Secure roofing material over edges at the rake.	
27	Spread gravel by hand.	22/82
28	Spread gravel by machine.	23/85
29	(A30) Start a built-up.	
30	(A10,A29) Start built-up roof at an eave.	24/88
31	(A18) Tape insulation joints.	
32	Underlay felt by hand.	25/92
33	Underlay felt by machine.	26/95
34	Waterproof a wooden deck.	27/99
B.	FLASHING/SEALING JOINTS	
01	(C35) Caulk plumbing vents.	
02	(B04,B20,G26) Flash a chimney.	28/104
03	Flash a cricket (saddle).	29/108
04	(B02) Flash a fascia.	
05	(B19) Flash a hip/ridge with metal.	30/112
06	(B12,C03,G14) Flash a hip/ridge for roll roofing.	31/116
07	(B16) Flash a parapet.	32/120
08	Flash a ring drain.	33/124
09	(B11) Flash a roof drain (lead).	34/129
10	Flash a skylight (membrane).	35/133
11	(B09) Flasha soil pipe (lead).	
12	(B06) Flash a spandrel beam.	
13	Flash a valley with metal.	36/136
14	(CO1,CO2,G13,G16,G18) Flash a valley with roll roofing.	37/140
15	Flash a vent.	38/144
16	(B07) Flash a wood dormer.	
17	Flash an expansion joint with membrane.	39/148
18	(A05) Install a drip edge.	
19	(B05) Install galvanized vent flashing.	
20	(B02) Waterproof a flashing joint.	
C.	INSTALLING SHINGLES	
01	(B14) Chalk a line for a new valley.	
02	(B14) Chalk a straight line.	
03	(C30) Chalk line the ridge.	
04	Cut starter course on "T"lock shingles.	40/153

DUTY/TASK		PO/Page No.
C.	INSTALLING SHINGLES Continued	
05	Cut wood ridges (top shingle butt first).	41/157
06	(G12) Dub asphalt (fiberglass) shingles.	42/161
07	(G12) Dub wood shingles.	43/164
08	(C16) Eliminate overlap on the starter course.	
09	(C16) Lay a six-inch pattern for a butt-up tie in.	
10	(C16) Lay butt-up shingles.	
11	Lay felt under ridge shingles.	44/167
12	(C16) Lay pattern lines for a six inch tie-in.	
13	(C16) Lay pattern lines for a straight up tie-in.	
14	Lay rigid asbestos (concrete) shingles.	45/171
15	Lay roll roofing.	46/175
16	(A26,C08,C90,C10,C12,C13,C38,C39, C40,C46) Lay square butt shingles.	47/179
17	(C19,C24,C25,C26) Lay "T" lock tie-in pattern.	48/183
18	Lay terra cotta shingles.	49/187
19	(C17) Lay tie-ins for uneven eaves.	
20	Lay tile shingles.	50/192
21	Lay wood shakes.	51/196
22	Lay wood shingles.	52/200
23	(C28) Make a pattern for hip and valley shingles.	
24	(C17) Measure for tie-in.	
25	(C17) Position starting course on bottom edge by "backing down".	
26	(C17) Pre-cut rake shingles ("T" lock).	
27	Shingle a closed valley.	53/204
28	(C23) Shingle a hip.	54/207
29	(C42) Shingle a hip (asbestos, concrete).	55/211
30	(A15,C03,C37,C43,C45) Shingle a ridge.	56/215
31	Shingle a ridge (wood shakes).	57/218
32	Shingle a ridge with a ridge roll.	58/222
33	Shingle an open valley.	59/226
34	Shingle a Boston Ridge (wood shake).	60/229

DUTY/TASK		PO/Page No.
C.	INSTALLING SHINGLES Continued	
35	(B01) Shingle around a pipe.	61/233
36	(C44) Shingle a woven hip (wood shakes.	62/237
37	(C30) Space the shingle course at the ridge.	
38	(C16) Square up pattern chalk lines.	
39	(C16) Straighten horizontal lines.	
40	(C16) Straighten vertical bond lines.	
41	Strip lay asphalt/fiberglass shingles.	63/241
42	(C29) Trim hip and ridge shingles (asbestos, concrete).	
43	(C30) Trim hip and ridge shingles (asphalt, fiberglass).	
44	(C36) Trim hip and ridge shingles (wood shakes).	
45	(C29) Trim rakes.	
46	(C16) Trim the starter course.	
D.	PREPARING FOR THE JOB	
01	(D28) Review work activities with job requester.	
02	Construct scaffolding (chicken ladder).	64/246
03	(D27) Determine run.	
04	(D27) Determine span.	
05	Erect hoists.	65/250
06	(D28) Set up work schedules.	
07	(D27) Estimate equipment required.	
08	(D27) Estimate labor (time).	
09	(D27) Estimate materials required.	
10	(D27) Fill out job estimate sheet.	
11	(D29) Fill in low spots.	
12	(D29) Inspect the deck.	
13	(D28) Inventory materials/equipment.	
14	(C02) Lay chalk lines (vertical, horizontal).	
15	(E11,E12) Load the roof.	66/254
16	Load/unload trucks.	67/257
17	(D27) Measure roof pitch.	
18	Perform wind uplift test.	68/260

		DUTY/TASK	PO/Page No.
D.		PREPARING FOR THE JOB Continued	
	19	(D28) Prepare daily work schedules.	
	20	(D29) Remove loose debris.	
	21	(D29) Remove roof obstructions (Nails, old flashing, T.V. antennae).	
	22	(D25,D29) Remove old roofing.	
	23	(D28) Schedule work assignments.	
	24	Set up a chute.	69/264
	25	(D22,D26,G10) Tear off gravel roof.	70/268
	26	(D25) Tear off roof.	
@	27	(D03,D04,D07,D08,D09,D10,D17) Provide a job estimate.	71/272
@	28	(D01,D06,D13,D19,D23) Plan work schedules.	72/276
@	29	(D11,D12,D20,D21,D22,D24) Prepare deck for re-roofing.	73/280
E.		OPERATING AND MAINTAINING TOOLS/POWER EQUIPMENT	
	01	(E04) Add oil.	
	02	Adjust mini-mopper spray.	74/284
	03	(E17) Adjust the carburetor.	75/287
	04	(E01) Change oil.	76/291
	05	Change spark plug.	77/294
	06	Clean air filter.	78/298
	07	Clean contact points.	79/302
	08	Clean fuel filter.	80/306
	09	(E10) Clean hand tools.	
	10	(E09,E13) Clean portable tools (hand/power).	81/310
	11	(D15) Hoist materials to roof (manually).	
	12	(D15) Hoist materials to roof (power).	
	13	(E10) Lubricate power equipment/ tools.	
	14	Record daily engine operating hours.	82/314
	15	Replace pulley belts on power equipment.	83/317
	16	Sharpen blades.	84/321
	17	(E03) Start/stop the engine.	
F.		OPERATING TANKERS, KETTLES	
	01	(F05,F14) Assemble/disassemble hot conduit.	85/325
	02	Attach LP lines to kettle.	86/329

	DUTY/TASK	PO/Page No.
F.	OPERATING TANKERS, KETTLES Continued	
03	Clean the kiln.	87/332
04	Clean the tank.	88/336
05	(F01) Determine bitumen and heating area.	
06	Fire a kerosene-fed kettle.	89/340
07	(F08) Fire a kettle (manual/automatic).	90/343
08	(F07) Fire an LP fed kettle.	
09	(F15) Level the kettle.	91/346
10	Load bitumen.	92/350
11	Keep kettle temperatures within limits.	93/354
12	Perform operator check.	94/357
13	Pump hot bitumen.	95/360
14	(F01) Set up the hot conduit.	
15	(F09) Set up the kettle.	
G.	REPAIRING ROOFS	
01	Apply plastic cement to an old valley.	96/364
02	Eliminate leak along seam/edge of overlapping felt.	97/369
03	Install tin shingle to wood roof.	98/373
04	Isolate leak in roof.	99/378
05	(G25) Patch a blister.	100/381
06	Remove a ridge shingle.	101/385
07	Replace an asphalt/fiberglass shingle.	102/390
08	Replace a shingle (wood shake).	103/395
09	Replace a valley with rolled roofing.	104/400
10	(D25) Skim roof membrane from worn insulation.	
11	Tighten loose felt edges.	105/405
12	(C06,C07) Trim back shingles.	
13	(B14) Waterproof a blind valley.	
14	(B06) Waterproof a ridge.	
15	(G23) Waterproof a split in a BUR.	106/408
16	(B14) Waterproof a valley.	
17	Waterproof chimney flue cracks.	107/412
18	(B14) Waterproof a full lack valley.	
19	(G20) Waterproof an asphalt/fiberglass shingle.	108/415
20	(G19) Waterproof asphalt/fiberglass shingle joints.	

G. REPAIRING ROOFS Continued

DUTY/TASK		PO/Page No.
21	Waterproof loose mortar joints.	109/419
22	Waterproof plumbing vent.	110/422
23	(G15) Waterproof roof cracks.	
24	Waterproof shingle cracks (wood shakes).	111/426
25	(G05) Waterproof small holes.	
26	(B02) Waterproof vertical walls that penetrate the roof.	

APPENDIX B

DEFINITIONS OF TERMS

APPENDIX B

DEFINITIONS OF TERMS

A number of terms frequently used in this guide may be unfamiliar to the reader; others may be familiar, but in the context of this handbook have been assigned special meanings.

AFFECTIVE.

Skills which emphasize an attitude, feeling, emotion, or degree of acceptance and rejection.

CATALOG.

A comprehensive collection of performance objectives, performance guides, and related data developed in a specific domain.

CBVE (COMPETENCY-BASED VOCATIONAL EDUCATION).

A methodology of instruction that (a) identifies the abilities and skills needed for on-the-job performance; (b) informs students and teachers of the precise and detailed learning objectives required to achieve these competencies; (c) emphasizes performance standards in testing, course requirements, and/or graduation; and (d) facilitates learning by letting each student master the task prior to advancing to another.

CHECKPOINT.

A point in the development of the V-TECS product when material must be sent to V-TECS central office for quality review.

CIP (CLASSIFICATION OF INSTRUCTION PROGRAM) CODE.

A code developed by the U.S. Office of Education to identify a specific cluster of related jobs for training program identification.

COGNITIVE.

Skills which emphasize the recall of knowledge and development of intellectual abilities.

COMPETENCY.

Proficiency in the knowledge and skills required of workers in a particular occupation or occupational specialty; a term used by educators to mean program goal, duty, task, or objective. In some cases the terms are essentially synonymous.

CONDITIONS.

Describes the situation for competent task performance, including tools and equipment to be used, and limitations under which the tasks will be performed.

CONSORTIUM.

A group of state agencies, institutions, or other entities which have been legally constituted through letters of commitment, agreements, or by assignment of higher authorities to work together toward the solution of problems in education. A consortium, for the purposes of this work, must have membership from autonomous agencies and institutions which cut across state boundaries as they attempt to solve problems or meet goals.

CRITERION-REFERENCED MEASURES.
An evaluative procedure used to determine if a student has mastered a performance objective.

CROSS-REFERENCE TABLE.
A table that identifies the relationship among duties and tasks found in the occupational inventory and the performance objectives in the final catalog. Also noted are percentages of incumbents performing the tasks by D.O.T.

CURRICULUM GUIDE.
An instructional resource developed from a V-TECS catalog to guide CBVE for an occupation.

DICTIONARY OF OCCUPATIONAL TITLES (D.O.T.).
A document published by the U.S. Department of Labor, Employment and Training Administration. This publication groups occupations into systematic occupational classification structures based on interrelationships of job tasks and requirements.

DISTRACTOR.
An incorrect response to a multiple-choice or true/false test item.

DOMAIN (OCCUPATIONAL DOMAIN).
A group of job titles that are related on the basis of required skills and knowledge.

D.O.T. CODE.
A nine-digit number used to identify a specific job within a given calendar year.

DUTY.
A cluster of related tasks performed by incumbent workers in an occupational domain.

ENABLING OBJECTIVE.
An objective related to background knowledge or skills that are prerequisite to the mastery of a given task.

FIELD REVIEW.
The process of using and refining drafts of V-TECS materials for the purpose of identifying content errors or technical problems.

GUIDE SHEET.
Instructional information including the duty, performance objective, task, performance of standard, survey of standard, conditions for performance of tasks, enabling objectives,resources, teaching activities, criterion-referenced measures, and performance guide.

JOB.
A group of tasks performed by a job incumbent.

JOB INCUMBENT.
An individual who is currently employed in an occupation.

OCCUPATIONAL ANALYSIS (Task Analysis).
The process of reviewing elements of a job for the purpose of improving training program content across program levels of vocational-technical education.

OCCUPATIONAL INVENTORY(Task Inventory Booklet).
A survey instrument listing tasks performed and tools and equipment used by job incumbents in an occupational domain.

OCCUPATIONAL SURVEY.
The procedures for collecting data to identify the duties and tasks that comprise one or more jobs, job types, or career field ladders for the collection and analysis of information concerning such duties.

O.E./CIP CODE.
A code developed by the U.S. Office of Education to identify a specific cluster of related jobs for training program identification.

PERFORMANCE-BASED INSTRUCTION.
Instruction which requires the learner's demonstration of specific competencies. The desired abilities are selected before the instruction is described and are clearly defined as observable performance objectives.

PERFORMANCE CHECKLIST.
A list of performance steps derived from the performance guide to record acceptable or unacceptable performance of each step of a task.

PERFORMANCE GUIDE (PG).
A series of steps required for performance of a task arranged in the sequence ordinarily followed.

PERFORMANCE OBJECTIVE (PO).
A statement, in precise measurable terms, of a particular behavior to be exhibited by a learner under specified conditions, including a standard of performance.

PSYCHOMOTOR.
Skills which emphasize manipulation of material or tools.

QUALITY REVIEW.
A review of content by V-TECS staff or designated representative to examine quality of content, format, and style of V-TECS product(s).

RESOURCES.
Materials which are used to develop instruction and/or learner-specific objectives.

SOURCE OF STANDARD.
A person or origin from which the information establishing the standard is received.

STANDARD.
The criteria used to determine if a task has been successfully or unsuccessfully performed.

STATE-OF-THE-ART REFERENCE.

Current materials from which information or resources can be found to facilitate instruction.

STATE-OF-THE-ART (SOA) STUDY.

Research conducted to determine the current status of performance-based instructional materials and practices in the domain area under study and to obtain other information that might be useful in catalog development.

SUBJECT-MATTER EXPERT.

A highly experienced person (incumbent worker/instructor) who assists in identifying task performance steps, skills, and knowledge necessary to perform the job.

TASK.

A unit of work activity which constitutes logical and necessary steps in the performance of a duty. A task has a definite beginning and ending point in its accomplishments and generally consists of two or more definite steps.

TASK ANALYSIS.

The process of reviewing elements of a job for the purpose of improving training program content across program levels of vocational technical education.

TASK LIST.

A list of tasks performed by incumbents in a specific occupation domain.

TEACHING ACTIVITIES.

Methods and/or procedures for delivering instructional content to students.

TEST-ITEM BANK.

A collection of criterion-referenced test items coded for input and retrieval by computer or manual methods.

VALIDATION.

The process of assuring that all aspects of an occupational task analysis identifies the skills, knowledge, and attitudes performed in the occupation.

VERIFICATION.

The procedure of collecting data to substantiate an existing product; for example, task list verification.

V-TECS.

An acronym representing: Vocational-Technical Education Consortium of States; 795 Peachtree Street, N.E., Atlanta, Georgia 30365. A consortium of states that provides competency-based, vocational-technical education materials while conserving time and money through shared development and dissemination.

V-TECS CATALOG.

An incumbent-based description of the duties, tasks, performance objectives, performance guides, and related data in a specified occupation.

WORKING CONDITIONS.

The atmospheric and environmental conditions under which a worker performs a specific job.

WRITING TEAM.

A team of people representing instructors with subject matter expertise; persons having knowledge and experience in developing criterion-referenced measures; local or state supervisors in the domain being developed; workers and supervisors of incumbent workers whose function is to analyze occupational data and develop performance objectives for specific D.O.T. areas.

APPENDIX C

TOOLS AND EQUIPMENT BY PERCENTAGE OF USE

APPENDIX C

TOOLS AND EQUIPMENT BY PERCENTAGE OF USE

Equipment Number	Equipment Description	Percentage Of Members Using	Number Of Members Using
2	Bars, Spud	98.10	103
93	Wheelbarrow	98.10	103
4	Broom, Push	97.14	102
77	Screwdrivers, Blade, asstd.	96.19	101
43	Knife, Roofers	95.19	100
46	Ladders, asstd.	95.24	100
81	Shovel, Scoop	93.33	98
78	Screwdrivers, Star, asstd.	92.38	97
8	Buckets, Carrying	91.43	96
64	Reel, Chalk Line	91.43	96
69	Ropes, asstd.	90.48	95
5	Broom, Upright	88.57	93
82	Snips, Tin	87.62	92
89	Tape, Joint	87.62	92
45	Ladder, Wheel Hoist	85.71	90
13	Chisels, Wood, asstd.	84.76	89
7	Buckets	83.81	88
80	Sealers	83.81	88
31	Helmet, Hard Hat	82.86	87
34	Hoist, Power	81.90	86
41	Kit, First Aid	81.90	86
49	Mops, asstd.	80.95	85
6	Brush, Wire	80.00	84
74	Saw, Lumber	80.00	84
87	Stripper, Nail	78.10	82
9	Carrier, Hot, Wheel	77.14	81
10	Carts, Mop	76.19	80
48	Mop, Mini	76.19	80
62	Pump, Roof	76.19	80
91	Tearoff Machine	76.19	80
28	Hammer, Claw	74.29	78
26	Gun, Caulking, Cartridge	73.33	77
32	Hoist, Ladder, Wheel	73.33	77
71	Rule, Tape, Cloth	73.33	77
90	Tape, Machine	72.38	76
50	Nails, Roofing, asstd.	71.43	75
19	Drill, Power	70.48	74
20	Felt Layer, Combination	66.67	70
14	Cutter, Motorized	65.71	69

Equipment Number	Equipment Description	Percentage Of Members Using	Number Of Members Using
94	Wrench, Crescent	65.71	69
35	Hook, Ladder	63.81	67
30	Hatchet, Roofer's	62.86	66
27	Hacksaw	61.90	65
39	Kettle, Patch	61.90	65
42	Knife, Putty	61.90	65
76	Scratcher, Motorized	61.90	65
86	Stapler, Hammer	60.95	64
95	Wrench, Pipe	60.95	64
63	Putty	59.05	62
83	Solder	59.05	62
59	Pot, Solder	57.14	60
96	Wrenches, asstd., Hand	57.14	60
38	Kettle, Mobile	56.19	59
84	Square, Framing, Steel	54.29	57
15	Cutter/Puller, Nail	53.33	56
47	Levels, Various Lengths	52.38	55
33	Hoist, Manual	51.43	54
40	Kettle, Truck Mounted	51.43	54
75	Scratcher, Hand	50.48	53
57	Pliers, Side Cutting	49.52	52
68	Roller, Roof, Resilient Faced	48.57	51
25	Glasses, Safety	47.62	50
60	Pot, Sprinkler	46.67	49
58	Pot, Crack Filler	44.76	47
23	Files, asstd.	43.81	46
1	Bag, Tool	40.00	42
61	Pouch, Nail	39.05	41
29	Handsaw, 26 Inch Blade	38.10	40
66	Ripper, Shingle/Slate	37.14	39
36	Jack, Ladder, Adjustable	35.24	37
16	Dipper, Pouring	33.33	35
67	Rivnails	33.33	35
18	Drill, Hand	31.43	33
3	Belt, Web	30.48	32
44	Knife, Utility	27.62	29
88	Sweepers/Blowers, Power	27.62	29
51	Nails, Tube Lock	26.67	28
53	Pad, Hip	25.71	27
70	Rule, Push-Pull	25.71	27
92	Trowel, Flat	23.81	25
73	Saw, Jig	21.90	23
52	Nailset	20.95	22
21	Felt Layer, Roller	17.14	18

Equipment Number	Equipment Description	Percentage Of Members Using	Number Of Members Using
37	Jack, Roof	17.14	18
55	Plane	14.29	15
79	Scriber	13.33	14
17	Dividers, Wing	12.38	13
72	Rule, Zig-Zag	12.38	13
11	Chisel, Cold, asstd.	11.43	12
12	Chute	9.52	10
24	Filer, Saw	8.57	9
54	Pick, Tile	8.57	9
22	Pelt Layer, Stationary	5.71	6
56	Plane, Route	4.76	5
65	Respirator	4.76	5
85	Stake, Tile	3.81	4

APPENDIX D

SOURCES OF STANDARDS

APPENDIX D

SOURCES OF STANDARDS

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APPENDIX E

STATE-OF-THE-ART LITERATURE

APPENDIX E

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APPENDIX F

BIBLIOGRAPHY COMPILED BY THE SOUTH CAROLINA WRITING TEAM

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